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Ghent Generating Station Units 3 and 4, Ghent, Ky

Environmental Protection Agency, Atlanta, Ga Region IV

Aug 77

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EPA 904 / 9-77-022

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

GHENT GENERATING STATION
UNITS 3 AND 4

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IV
REGION IV 345 COURTLAND ST., ATLANTA, GA. 30308

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8. Performing Organization Rept. No.

9. Performing Organization Name and Address

Environmental Protection Agency, Region IV
345 Courtland St., NE
Atlanta, GA 30309

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Address

13. Type of Report & Period Covered Draft EIS

14.

15. Supplementary Notes

16. Abstracts

Project is located at river mile 536 on the Ohio River, 1.5 miles upstream from the town of Ghent in Carroll County, KY. This impact statement was prepared under the third part consultant procedure, outlined in the EPA January 11, 1977 regulations governing EIS preparation for industry projects requiring NPDES new source permits. The Applicant proposes to add two 500 NW, low sulfur content coal fired units to the Ghent Electric Generating Station, presently 1000 NW.

Major Issues raised on this project are the proliferation of power generating facilities within the Ohio River Valley and their attendant significant impact to ambient air quality. Identified secondary impacts would be a land use shift from rural agriculture to industrial and commerical uses.

17. Key Words and Document Analysis. 17a. Descriptors

Ghent
Carroll Co. Kentucky
new source
power generating
Ohio River

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EPA 904/9-77-022
NPDES Application Number: KY0041971
August 1977

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

for

Ghent Generating Station
Units 3 and 4
Ghent, Kentucky

prepared by

U. S. Environmental Protection Agency
Region IV
Atlanta, Georgia

Approved by:

John A. Little 8/3/77
Acting Regional Administrator Date

SUMMARY SHEET FOR ENVIRONMENTAL IMPACT STATEMENT

GHENT STATION UNITS 3 and 4
Kentucky Utilities Company
Carroll County, Kentucky

(X) Draft

( ) Final

U.S. Environmental Protection Agency, Region IV
345 Courtland Street N.E.
Atlanta, Georgia 30308
Phone 404/881/7458

1. Type of Action: Administrative (X) Legislative ( )

2. Description of Action:

The Environmental Impact Statement (EIS) was prepared by the Region IV office of the Environmental Protection Agency (EPA). EPA has prepared this document as lead Federal agency in fulfilling the requirements of the National Environmental Policy Act of 1969 (NEPA) and the EPA January 11, 1977 regulations: Preparation of Environmental Impact Statements for New Source NPDES Permits (42 CFR 6.900). NEPA requires all Federal agencies to assess the impacts which would occur following a major Federal action which will result in a significant impact on the human environment.

Kentucky Utilities, the Applicant, proposes to expand the Ghent Station by adding two 500 megawatt units which will approximately double the station's, electrical generating capacity. The Ghent station is located at river mile 536 on the Ohio River 1.5 miles upstream from the town of Ghent in Carroll County, Kentucky. The expansion would provide for increased electrical generating capacity within the Applicant's service area. The proposed capacity increase is consistent with the need for power projected by the Applicant.

The proposed project will involve the additional clearing of 13.3 acres to add to 60 acres formerly cleared during construction of the existing units 1 and 2. Necessary major components of the expansion are: Two generating units, a 660 foot stack, two mechanical draft cooling towers, expansion of the switchyard, expansion of ash pond, new water intake and discharge structures and a 40 mile long 345 kilovolt (kV) transmission line to the Frankfort area.

No construction has commenced for this expansion pending issuance of the EPA's NPDES Permit, EPA's Authority to Construct (EPA Regulations for the Prevention of Significant Deterioration of Air Quality, 40 CFR 52.21), the Corps of Engineers' Section 10 and Section 404 Construction Permit and necessary State approval certificates and permits.

3. Major Environmental Impacts

(A) Construction

Expansion of the Ghent Station represents a further commitment of additional acreage to industrial usage. Short term increase in air pollution, especially fugitive dust, is expected on and near the station. Pollutants will also be contributed to the Ohio River from site preparation runoff and construction of the new service water intake and discharge. Increased noise will result from the site construction and increased vehicular use of roadways in the construction areas. The construction work force will average about 300 during the seven year construction period. A potentially significant archeological site was located during initial survey work. A follow-up investigation revealed it to be of no significance. Significant historical items on the site are a 19th century barn and cemetery. These sites will not be affected by construction.

The proposed transmission line will increase electrical service to the growth areas near Frankfort and increase system reliability. Transmission construction represents by far the most significant quantities of land to be cleared. About 703 acres are needed, 365 acres of this is woodland and the remainder is presently farmland or otherwise open land. Work will result in localized short term air pollution and also siltation to nearby reaches of streams crossed by the line. Total project construction costs for units 3 & 4 and the transmission line will be about 497 million dollars.

(B) Operation

Operation impacts will occur for the life of the proposed facility, about 30 years. Most significant will be the impact to air quality by the contribution to the sulfur dioxide, nitrogen oxides and particulate levels within the Ohio River Valley area. Vapor emissions from the cooling towers will aggravate naturally occurring fog near the station. Units 3 & 4 will require coal usage at the station to double thereby increasing the amount of barge traffic which will affect river recreation. Greater visual and noise impact will be experienced by nearby residents. Units 3 and 4 are subject to Prevention of Significant Deterioration of Air Quality regulations. These units will take up 41 percent and 35 percent of the available sulfur dioxide (SO_2) 3 hour and 24 hour increments, respectively, thereby reducing the available deterioration increments for other large SO_2 sources which could potentially be constructed near Ghent in the future. The increased volume of intake water will cause greater quantities of orgamisms to be entrained through the plant resulting in greater mortality. A significant increase in the quantity of wastewater discharged to the Ohio River will result from operation of units 3 and 4. Wastewater discharges will be those associated with the plant service water system, cooling system, sanitary waste treatment system and coal pile and construction runoff. The discharge will have a minor impact on aquatic populations.

4. Agency Position on Mitigation Of Impacts

The proposed facility will be required to meet all New Source Performance Standards pertaining to water discharge and water quality standards under NPDES permitting authority and will also be restricted by emissions limitations for new source industries under the Clean Air Act. However, the EPA region IV has identified several potential adverse impacts which require further mitigation. Mitigative measures have been developed by the Agency and the Applicant. The Applicant has agreed to:

Monitor groundwater to detect any contamination and, if needed, take steps to reduce it.

Control site erosion and reduce sediment entering waters of the United States

Provide for adequate, environmentally acceptable waste disposal

Keep construction related noise and fugitive dust production to a minimum

Restricted use of herbicides on transmission corridor work

Provide for identification of valuable vegetation and wildlife habitat along the transmission corridor needed with the station expansion

Provide for identification of archeological resources along the transmission corridor needed with the Station expansion

The EPA considers these to be prerequisite to NPDES Permit approval.

5. Alternatives to the Proposed Action Considered

(A) Alternatives not requiring new capacity

(1) upgrade or reactivate old units
(2) purchase capacity
(3) load curtailment
(4) conservation

(B) Alternatives requiring new capacity

(1) Alternative sites
(2) Alternative fuels
(3) Alternative plant system design
(4) Alternative waste treatment
(5) Alternative electrical transmission

6. Federal, State and local agencies and interested groups requested to comment

Federal Agencies

Bureau of Outdoor Recreation
U.S. Coast Guard
Corps of Engineers
Council on Environmental Quality
Department of Commerce
Department of Health, Education and Welfare
Department of the Interior
Department of Transporation
Department of Housing and Urban Development
Economic Development Administration
Energy Research and Development Administration
Federal Highway Administration
Fisheries & Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey
National Park Service
Soil Conservation Service

Federal Energy Administration
Federal Power Commission

Members of Congress

Honorable Richard Lugar
United States Senate

Honorable Birch Bayh
United States Senate

Honorable Wendell Ford
United States Senate

Honorable Walter D. Huddleston
United States Senate

Honorable Romano L. Mazzoli
U.S. House of Representatives

Honorable M. Gene Snyder
U.S. House of Representatives

Honorable Lee H. Hamilton
U.S. House of Representatives

State

Kentucky

Bureau of Intergovermental relations
Department for Natural Resources and Environmental Protection
Department of Fish and Wildlife Resources
Kentucky Public Service Commission

Honorable Julian M. Carroll, Governor of Kentucky
Department of Energy

John M. Berry Jr.
Kentucky State Senate

Robert A Jones
Kentucky State Representative

Indiana Budget Agency (A-95 State Clearinghouse)

Local

Harry A. Berge, Mayor
Carrollton, KY

Robert M. Westrick, Judge
Carroll County

F.R. Weldon, Mayor
Warsaw, KY

Clarence Davis
Judge, Gallatin County

Roy Branham, Board President
of Vevay, Indiana

Eddie James
County Judge, Switzerland County

Interested Groups

National Wildlife Federation
League of Kentucky Sportsmen
The Nature Conservancy
Citizens League to Protect the Surface Rights
Garden Club
Izaak Walton League
Kentuckian's for Environmental Planning
Kentucky Federation of Women's Clubs
League of Women Voters
Appalachian Research and Defense Fund
Home Builders Association
Kentucky Coal Association
Hardin County Environmental Council
Save The Valley
Kentucky Water Resources Research Institute
Natural Resources Defense Council
Friends of the Earth
Environmental Defense Fund
Sierra Clubs
Save Our Streams
Tennessee Conservation League
The Filson Club
Kentucky Rivers Coalition
Save our Kentucky
Citizens Energy Coalition
Purdue Environmental Action

7. This draft EIS was made available to the Council on Environmental Quality (CEQ) and the public on AUG 26 1977.

Table 2.2-10

FARMS, LAND IN FARMS, AND LAND USE: 1969

Counties:		Carroll	Gallatin	Switzerland
All farms	number	485	373	785
Land in farms	acres	64,931	49,143	97,552
Average size of farm	acres	133.8	131.7	124.2
Approximate land area	acres	83,392	63,744	141,440
Proportion in farms	percent	77.9	77.1	69.0
Value of land and buildings	dollars	16,395,972	11,599,646	21,575,946
Average per farm	dollars	33,806	31,098	27,485
Average per acre	dollars	252.51	236.03	221.17
Land in Farms According to Use				
Total cropland	farms	447	345	759
	acres	33,423	22,777	43,970
Harvested cropland	farms	431	312	736
	acres	9,348	5,846	19,646
Number of farms by acres harvested:				
1 to 9 acres		220	161	287
10 to 19 acres		73	56	108
20 to 29 acres		42	34	108
30 to 49 acres		42	30	131
50 to 99 acres		37	19	70
100 to 199 acres		14	12	28
200 to 499 acres		3	-	3
500 to 999 acres		-	-	1
1,000 acres and over		-	-	-
Cropland used only for pasture or grazing	farms	276	173	383
	acres	19,599	12,450	16,503
All other cropland (see text)	farms	165	139	348
	acres	4,476	4,481	7,821
Woodland including woodland pasture	farms	248	188	468
	acres	17,907	15,375	19,676
All other land (see text)	farms	365	285	654
	acres	13,601	10,991	33,906
Irrigated land	farms	78	22	43
	acres	317	87	168

Source: U.S. Department of Commerce 1972.

Table 2.2-9

Urban and Rural Land Use Distribution: 1969

Areas	Carroll County, Kentucky (Acres)	Gallatin County, Kentucky (Acres)	Switzerland County Indiana (Acres)
Rural Area	79,657	63,605	141,440*
Land in farm	64,931	49,143	97,552*
Rural non-farm	14,548	14,062	43,888
Small water areas	288	400	320**
Urban Area	646.1	-	-
Developed residential	191.4	-	-
Developed commercial	82.7	-	-
Developed public/semi-public	51.0	-	-
Developed industrial	41.0	-	-
Developed recreational	280.0	-	-
Total Area	80,803	63,744	141,440

* Source: North Kentucky Area Development District 1974.

** Switzerland County Development Board.

2.2.2.1 Present Land Use

In the area of study, there is only one urban area, Carrollton, Kentucky, (1970 population of 3,884). The U.S. Bureau of Census defines an urban area as a place of 2,500 or more inhabitants. The remainder of the study area is considered rural.

As shown by Table 2.2-9, the principal land use of the three counties is agricultural. Of the total land area (285,987 acres), 74 percent (or 211,626 acres) is designated as farm land. Table 2.2-10 lists the breakdown of farms in the study area according to number of farms, farm land area and farm land use for 1969. Table 2.2-11 lists the types of crops harvested during 1969 for the three-county area. Tobacco is the most important crop in this area.

The second largest land use for the study area is rural non-farm, which includes the communities with less than 2,500 inhabitants plus all other rural land not considered farm land. This area makes up 25 percent (72,498 acres) of the land area of the three counties being discussed.

A small percentage of land is used for commercial, industrial and recreational purposes. Figure 2.2-4 shows these areas. Table 2.2-12 shows the number of wholesale and retail businesses by county, and Table 2.2-13 lists the industries. Recreational developed areas can be broken down into two categories: public and private. Switzerland County, Indiana has 1,250 acres of land which are considered to be for recreational purposes. Carroll and Gallatin Counties in Kentucky have 3,651 acres of recreational land. General Butler State Park is the only state park located in the study area. The park has 809 acres of land and the following facilities are available:

Camping
Cabins
Hotel
Nine-hole golf course
25-acre lake
Tennis
Picnicking
Hiking
Boating
Fishing
Riding
Swimming

Table 2.2-8

Income and Poverty Status in 1969 for Ccunties: 1970

Counties	Carroll	Gallatin	Switzerland
INCOME OF FAMILIES AND UNRELATED INDIVIDUALS			
All families	2,307	1,056	1,691
Less than $1,000	52	70	53
$1,000 to $1,999	138	107	64
$2,000 to $2,999	177	106	119
$3,000 to $3,999	195	99	142
$4,000 to $4,999	193	38	71
$5,000 to $5,999	213	125	123
$6,000 to $6,999	209	82	152
$7,000 to $7,999	155	59	121
$8,000 to $8,999	176	119	108
$9,000 to $9,999	189	75	127
$10,000 to $11,999	278	63	222
$12,000 to $14,999	179	64	219
$15,000 to $24,999	114	42	131
$25,000 to $49,999	34	3	10
$50,000 or more	5	4	9
Median income	$6,888	$5,864	$7,839
Mean income	$7,731	$6,539	$8,927
Families with female head	225	124	121
Mean income	$4,414	$4,058	$6,066
All families and unrelated individuals	2,880	1,297	2,201
Median income	$5,091	$5,194	$6,237
Mean income	$6,802	$5,754	$7,410
All unrelated individuals	573	241	510
Median income	$2,173	$1,627	$1,740
Mean income	$3,060	$2,313	$2,377
Female unrelated individuals	398	147	355
Mean income	$2,635	$1,677	$2,466
Per capita income of persons	$2,311	$1,844	$2,590
TYPE OF INCOME OF FAMILILS			
All families	2,307	1,056	1,691
With wage or salary income	1,970	837	1,303
Mean wage or salary income	$7,064	$6,664	$7,506
With nonfarm self-employment income	242	58	245
Mean nonfarm self-employment income	$5,847	$5,550	$6,008
With farm self-employment income	451	180	781
Mean farm self-employment income	$2,592	$2,628	$2,478
With Social Security income	504	268	521
Mean Social Security income	$1,348	$1,412	$1,544
With public assistance or public welfare income	120	37	55
Mean public assistance or public welfare income	$ 835	$ 745	...
With other income	502	108	431
Mean other income	$1,108	$1,176	$2,469
INCOME LESS THAN POVERTY LEVEL			
Families	392	260	219
Percent of all families	17.0	24.6	13.0
Mean family income	$2,213	$1,712	$1,853
Mean income deficit	$1,271	$1,359	$1,221
Percent receiving public assistance income	19.6	6.2	2.3
Mean size of family	3.89	3.44	3.54
With related children under 18 years	225	146	103
Mean number of related children under 18 yr.	2.85	2.64	3.10
Families with female head	71	69	44
With related children under 18 years	52	54	26
Family heads	392	260	219
Civilian male heads under 65 years	203	131	113
Percent in labor force	80.3	64.1	62.8
Unrelated individuals	227	132	262
Percent of all unrelated individuals	39.6	54.8	51.4
Mean income	$ 957	$ 823	$ 954
Mean income deficit	$ 817	$ 933	$ 776
Percent receiving public assistance income	14.5	20.5	17.2
Persons	1,751	1,027	1,038
Percent of all persons	20.8	24.9	16.5
Percent receiving Social Security income	20.0	19.4	31.4
Percent 65 years and over	20.8	22.1	26.6
Percent receiving Social Security income	79.1	74.0	90.2
Related children under 18 years	583	408	314
Percent living with both parents	60.4	65.7	62.7
Households	447	234	216
Percent of all households	22.7	31.3	23.0
In owner occupied housing units	213	114	126
Mean value of unit	$8,836	$8,888	$7,639
In renter occupied housing units	234	120	90
Mean gross rent	$ 61	$ 56	...
Percent lacking some or all plumbing fac.	43.2	37.6	44.9

Source: U. S. Department of Commerce, Bureau of Census, 1970 Census of Population, General Social and Economic Characteristics, Kentucky and Indiana

The average income and percent of families with less than poverty level income are presented in Table 2.2-8. Carroll County has the highest per capita income ($2,307 per year) largely due to the larger share of industry present in this county (North Kentucky Area Development District 1974).

Economic projection data are available for Carroll and Gallatin Counties. Because Carroll County has one of the strongest economies, total employment is expected to grow 36 percent between 1972 and 1990. Gallatin County is expected to continue to have a relatively weak economy with total employment growth of 14 percent between 1972 and 1990. Population growth for Gallatin County is expected to be 47 percent between 1970 and 1990, necessitating more and more Gallatin residents to seek employment outside the County (North Kentucky Area Development District 1974).

2.2.2 Land Use

Land use in the 10-mile radius of Kentucky Utilities' Ghent plant may be characterized by the following categories:

- Urban
- Rural non-farm
- Rural farm

These categories can further be broken down into residential, commercial, industrial, agricultural and recreational areas. The discussion of land use will be limited to the above categories for the following counties:

- Carroll County, Kentucky
- Gallatin County, Kentucky
- Switzerland, Indiana

These counties were selected because they make up the greater part of the land area within 10 miles of the Ghent plant and also because of the availability of land use data by county units.

Table 2.2-7

Industry of Employed Persons and Occupation of Experienced Unemployed Persons for Counties:1970

Counties	Carroll	Gallatin	Switzerland
INDUSTRY			
Total employed, 16 years old and over	2,982	1,254	2,426
Agriculture, forestry, and fisheries	348	199	458
Mining	3	-	20
Construction	202	128	174
Manufacturing	926	321	806
Furniture and lumber and wood products	173	94	14
Metal industries	242	38	77
Machinery, except electrical	19	20	31
Electrical machinery, equipment, and supplies	32	14	69
Transportation equipment	73	57	9
Other durable goods	55	23	68
Food and kindred products	12	4	107
Textiles and fabricated textile products	10	25	10
Printing, publishing and allied industries	21	4	-
Chemicals and allied products	267	24	11
Other nondurable goods (incl. not specified mfg. indus.)	22	18	410
Railroads and railway express service	29	6	4
Trucking service and warehousing	92	26	21
Other transportation	46	36	30
Communications	11	-	19
Utilities and sanitary services	36	14	8
Wholesale trade	54	58	19
Food, bakery, and dairy stores	96	33	57
Eating and drinking places	93	65	27
General merchandise retailing	40	9	10
Motor vehicle retailing and service stations	58	48	45
Other retail trade	195	48	95
Banking and credit agencies	30	26	45
Insurance, real estate, and other finance	28	40	20
Business and repair services	51	8	23
Private households	51	26	35
Other personal services	72	19	73
Entertainment and recreation services	7	-	24
Hospitals	66	3	37
Health services, except hospitals	42	14	38
Elementary, secondary schools, and colleges-government	125	65	111
Elementary, secondary schools, and colleges-private	7	20	33
Other education and kindred services	-	4	13
Welfare, religious, and nonprofit membership organizations	31	-	21
Legal, engineering, and miscellaneous professional services	28	3	12
Public administration	215	35	148
Total employed, 14 and 15 years old	25	25	34
Agriculture	-	-	4
Nonagriculture industries	25	25	30

Source: U. S. Department of Commerce, Bureau of Census, 1970 Census of Population, General Social and Economic Characteristics, Kentucky and Indiana

Table 2.2-6

Occupation and Earnings for Counties: 1970

Counties	Carroll	Gallatin	Switzerland
OCCUPATION			
Total employed, 16 years old and over	2,982	1,254	2,426
Professional, technical, and kindred workers	250	64	170
Engineers	38	-	16
Physicians, dentists, and related practitioners	12	-	4
Health workers, except practitioners	21	3	12
Teachers, elementary and secondary schools	77	45	83
Technicians, except health	25	-	-
Other professional workers	77	16	55
Managers and administrators, except farm	295	87	108
Salaried: Manufacturing	35	6	4
Retail trade	25	18	5
Other industries	143	34	67
Self-employed: Retail trade	70	20	24
Other industries	22	9	8
Sales workers	130	57	81
Retail trade	95	22	63
Other than retail trade	35	35	18
Clerical and kindred workers	345	164	203
Craftsmen, foremen, and kindred workers	455	220	332
Automobile mechanics, including body repairmen	56	22	17
Mechanics and repairmen except automobile	78	30	65
Metal craftsmen, except mechanics	12	3	32
Construction craftsmen	134	109	95
Other craftsmen	175	56	123
Operatives, except transport	499	180	499
Durable goods manufacturing	334	152	146
Nondurable goods manufacturing	102	11	314
Nonmanufacturing industries	63	17	39
Transport equipment operatives	149	75	122
Laborers, except farm	152	98	182
Construction laborers	18	12	27
Freight, stock, and material handlers	66	32	94
Other laborers, except farm	68	54	61
Farmers and farm managers	206	96	388
Farm laborers and farm foremen	108	79	60
Service workers, except private household	342	113	254
Cleaning service workers	66	14	50
Food service workers	133	59	81
Health service workers	28	5	43
Personal service workers	33	10	49
Protective service workers	75	22	31
Private household workers	51	21	27
MEDIAN EARNINGS IN 1969 OF PERSONS IN EXPERIENCED CIVILIAN LABOR FORCE FOR SELECTED OCCUPATION GROUPS			
Male, 16 years old and over with earnings	$5,816	$5,567	$5,979
Professional, managerial, and kindred workers	8,240	7,700	8,050
Craftsmen, foremen, and kindred workers	6,341	6,640	6,653
Operatives, including transport	5,675	5,758	6,662
Laborers except farm	3,342	1,857	5,690
Farmers and farm managers	4,984	3,938	3,379
Farm laborers, except unpaid, and farm foremen	1,891	2,929	...
Female, 16 years old and over with earnings	$3,185	$2,915	$3,857
Clerical and kindred workers	3,290	3,425	4,026
Operatives, including transport	3,571	2,675	4,254

Source: U. S. Department of Commerce, Bureau of Census, 1970 Census of Population, General Social and Economic Characteristics, Kentucky and Indiana

Table 2.2-5

Employment Characteristics for Counties: 1970

Counties	Carroll	Gallatin	Switzerland
EMPLOYMENT STATUS			
Male, 16 years old and over	2,838	1,335	2,192
Labor force	2,091	923	1,555
Percent of total	73.7	69.1	70.9
Civilian labor force	2,091	923	1,555
Employed	1,940	871	1,482
Unemployed	151	52	73
Percent of civilian labor force	7.2	5.6	4.7
Not in labor force	747	412	637
Inmate of institution	73	-	4
Enrolled in school	112	32	115
Other: Under 65 years	250	193	258
65 years and over	312	187	260
Female, 16 years old and over	3,080	1,460	2,331
Labor force	1,153	411	978
Percent of total	37.4	28.2	42.0
Civilian labor force	1,153	411	978
Employed	1,042	383	944
Unemployed	111	28	34
Percent of civilian labor force	9.6	6.8	3.5
Not in labor force	1,927	1,049	1,353
Inmate of institution	24	-	3
Enrolled in school	82	76	131
Other: Under 65 years	1,376	718	804
65 years and over	445	255	415
Male, 16 to 21 years old	340	157	262
Not enrolled in school	214	95	103
Not high school graduate	133	76	44
Unemployed or not in labor force	67	28	33
WORKERS IN 1969 BY WEEKS WORKED			
Male, 16 years old and over	2,332	1,023	1,730
50 to 52 weeks	1,628	710	1,123
27 to 49 weeks	417	218	410
26 weeks or less	287	95	197
Female, 16 years old and over	1,451	590	1,141
50 to 52 weeks	678	212	647
27 to 49 weeks	301	131	282
26 weeks or less	472	247	212
CLASS OF WORKER, 16 YEARS OLD AND OVER			
Male employed	1,940	871	1,482
Private wage or salary workers	1,332	637	739
Government workers	248	69	269
Local government workers	86	23	103
Self-employed workers	344	146	465
Unpaid family workers	16	19	9
Female employed	1,042	383	944
Private wage or salary workers	699	263	642
Government workers	264	104	163
Local government workers	149	31	116
Self-employed workers	72	6	94
Unpaid family workers	7	10	45
Male employed, in agriculture	329	196	397
Wage or salary workers	114	84	43
Self-employed workers	204	97	350
Unpaid family workers	11	15	4
Female employed, in agriculture	5	3	61
Wage or salary workers	-	-	13
Self-employed workers	5	3	26
Unpaid family workers	-	-	22
LABOR MOBILITY FOR MALES			
Male, 30 to 49 years old in 1970	890	425	634
Nonworker in 1965, nonworker in 1970	51	26	58
Nonworker in 1965, worker in 1970	64	15	30
Worker in 1965, nonworker in 1970	67	52	42

Source: U. S. Department of Commerce, Bureau of Census, 1970 Census of Population, General Social and Economic Characteristics, Kentucky and Indiana

Table 2.2-4

Manufacturers with Over 100 Employees in the Study Area

Manufacturer	Products	Employment	Location
Consolidated Aluminum Corporation	Aluminum extrusion	122	Carrollton
Dow Corning Corporation	Silicones	104	Carrollton
Kawneer Company	Aluminum appliance trim; Auto parts	200	Carrollton
M & T Chemicals	Tin, organic chemicals, coatings	241	Carrollton
Teledyne Wirz	Metal collapsible tubes	134	Carrollton

Source: North Kentucky Area Development District 1974.

Table 2.2-3

Employment in the Private Sector

SIC code	Industry	Number of employees, mid-March pay period	Taxable payrolls, Jan.-Mar. ($1,000)	Total reporting units	Number of reporting units, by employment-size class							
					1 to 3	4 to 7	8 to 19	20 to 49	50 to 99	100 to 249	250 to 499	500 or more
	CARROLL											
	Total	2,385	3,698	181	106	27	24	11	7	6	-	-
...	Agricultural services, forestry, fisheries	(D)*	(D)	1	-	1	-	-	-	-	-	-
...	Contract construction	216	617	15	8	4	-	2	-	1	-	-
17	Special trade contractors	(D)	(D)	7	4	2	-	-	-	1	-	-
171	Plumbing, heating, air conditioning	(D)	(D)	2	-	1	-	-	-	1	-	-
...	Manufacturing	964	1,787	10	-	1	1	1	3	4	-	-
28	Chemicals and allied products	(D)	(D)	2	-	-	-	-	-	2	-	-
281	Industrial chemicals	(D)	(D)	1	-	-	-	-	-	1	-	-
2818	Industrial organic chemicals,	(D)	(D)	1	-	-	-	-	-	1	-	-
283	Drugs	(D)	(D)	1	-	-	-	-	-	1	-	-
2833	Medicinals and botanicals	(D)	(D)	1	-	-	-	-	-	1	-	-
33	Primary metal industries	(D)	(D)	1	-	-	-	-	-	1	-	-
335	Nonferrous rolling and drawing	(D)	(D)	1	-	-	-	-	-	1	-	-
3352	Aluminum rolling and drawing	(D)	(D)	1	-	-	-	-	-	1	-	-
34	Fabricated metal products	(D)	(D)	2	-	-	-	-	1	1	-	-
346	Metal stampings	(D)	(D)	1	-	-	-	-	-	1	-	-
...	Transportation and other public utilities	134	214	9	2	1	4	2	-	-	-	-
...	Wholesale trade	501	515	16	4	3	3	1	4	1	-	-
505	Farm product raw materials	472	467	8	-	-	2	1	4	1	-	-
5059	Farm product raw materials, N.E.C.	472	467	8	-	-	2	1	4	1	-	-
...	Retail trade	369	358	74	47	12	12	3	-	-	-	-
54	Food stores	72	100	13	9	2	-	2	-	-	-	-
541	Grocery stores	(D)	(D)	11	8	1	-	2	-	-	-	-
55	Automotive dealers & Service Stations	77	75	16	11	2	2	1	-	-	-	-
554	Gasoline service stations	43	39	11	7	2	2	-	-	-	-	-
58	Eating and drinking places	94	57	17	10	2	5	-	-	-	-	-
...	Finance, insurance, and real estate	52	96	10	6	1	3	-	-	-	-	-
...	Services	139	104	42	35	4	1	2	-	-	-	-
80	Medical and other health services	57	50	11	8	1	1	1	-	-	-	-
...	Unclassified establishments	(D)	(D)	4	4	-	-	-	-	-	-	-
	GALLATIN											
	Total	268	264	71	48	13	9	1	-	-	-	-
...	Agricultural services, forestry, fisheries	(D)	(D)	1	1	-	-	-	-	-	-	-
...	Contract construction	(D)	(D)	1	1	-	-	-	-	-	-	-
...	Manufacturing	(D)	(D)	2	1	-	-	1	-	-	-	-
...	Transportation and other public utilities	29	36	6	4	-	2	-	-	-	-	-
...	Wholesale trade	48	77	10	6	2	2	-	-	-	-	-
...	Retail trade	132	92	35	21	10	4	-	-	-	-	-
...	Finance, insurance, and real estate	19	19	3	1	1	1	-	-	-	-	-
...	Services	15	15	13	13	-	-	-	-	-	-	-
	SWITZERLAND											
	Total	713	951	82	56	18	6	1	-	-	1	-
...	Mining	(D)	(D)	1	-	-	-	1	-	-	-	-
...	Contract construction	14	11	5	4	1	-	-	-	-	-	-
...	Manufacturing	(D)	(D)	6	3	1	1	-	-	-	1	-
31	Leather and leather products	(D)	(D)	1	-	-	-	-	-	-	1	-
314	Footwear, except rubber	(D)	(D)	1	-	-	-	-	-	-	1	-
3141	Shoes, except rubber	(D)	(D)	1	-	-	-	-	-	-	1	-
...	Transportation and other public utilities	13	16	4	2	2	-	-	-	-	-	-
...	Wholesale trade	9	16	3	2	1	-	-	-	-	-	-
...	Retail trade	116	86	38	28	7	3	-	-	-	-	-
...	Finance, insurance, and real estate	30	44	5	1	2	2	-	-	-	-	-
...	Services	38	29	19	16	3	-	-	-	-	-	-
...	Unclassified establishments	(D)	(D)	1	-	1	-	-	-	-	-	-

Source: U. S. Department of Commerce, Bureau of the Census, 1973, County Business Patterns, Kentucky and Indiana

* (D) - data withheld to avoid disclosure of information on individual reporting units.

by County, Historic (1940-1970) and Projected (1980-2020), Region IV (EPA 1972). Projection figures for Switzerland County in Indiana were obtained from the State Board of Health and were prepared by Division of Research, School of Business, Indiana University, 1976.

County-wide and city projections, as percent change per 10-year period, were then applied to each corresponding section. Table 2.2-2 presents the percent change incorporated in these population projections.

2.2.1.2 Employment, Income and Characteristics of Labor Force

This section describes the general economic activity for the area around the Ghent Power Station. The Counties of Carroll and Gallatin, Kentucky, and Switzerland, Indiana, will be addressed.

A detailed breakdown of employment in the private sector of the three counties for 1973 is given in Table 2.2-3. This table also indicates payrolls, number of establishments and employment-size class.

Carroll County has by far the strongest manufacturing sector of the three counties with 5 manufacturers hiring over 100 employees (Table 2.2-4). In 1972, manufacturing clearly dominated Carroll County's economy with 56.5 percent (1,060) of the total employment working in manufacturing (Northern Kentucky Area Development District 1974).

By comparison, Gallatin and Switzerland Counties are much less industrialized with per capita wages and the number in the labor force much less than Carroll County. Industry in Gallatin and Switzerland Counties is dominated mainly by several small industries and retail stores (U.S. Department of Commerce 1974).

Selected employment characteristics for the three counties' residents are shown in Table 2.2-5. A more detailed breakdown of occupations and earnings is given in Table 2.2-6, with a breakdown of employment by industry given in Table 2.2-7.

2.2.1-A Methodology Used in Estimating and Projecting Populations

2.2.1-A.1 Population Estimates

The population estimates (Figures 2.2-2 and 2.2-3 and Table 2.2-1) are based on the summation of the rural, rural town and urban populations within each section of the population wheel. The rural populations are based on house counts from enumeration district maps obtained from the State of Kentucky Highway Department 1970. The number of housing units was then multiplied by an average occupancy rate for each county as follows:*

Average Occupancy Rate, 1970

County	Farm	Non-Farm	All Homes
Carroll	3.46	3.29	-
Gallatin	3.48	3.00	-
Owen	3.15	2.74	-
Switzerland	-	-	2.57

The 1970 population of each urban area or rural town was then added to the rural population of each corresponding section. It sometimes became necessary to proportion an urban area or rural town's population between two or more sections.

2.2.1-A.2 Population Projections

Population projections for the years 1980 through 2020 are based on the best available studies for the urban and rural areas of the counties within the 10-mile radius of the Ghent plant. Projection figures for Carroll County, Kentucky, were obtained from Comprehensive Plan for Carroll County, Kentucky (Watkins and Associates 1974). Included in this report was an urban projection for the City of Carrollton which was also utilized in constructing the population wheels. (Carrollton was the only city in the 10-mile radius that is considered urban (population over 2500)). Projections for the Counties of Gallatin and Owen, Kentucky were obtained from Population

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* U.S. Department of Commerce 1971a.

tion centers of Carrollton (3,884), Prestonville (252), Sanders (268), Worthville (258) and Sparta (213). The population within a 10-mile radius is expected to increase to 21,979 by the year 2000. The average population density for this area in 1970 was 51 people per square mile and will increase to approximately 70 people per square mile by the year 2000.

The largest population increases, as indicated by projection figures, will occur in Gallatin County and the City of Carrollton. Gallatin County is expected to grow at a rate of 18 to 25 percent per decade through 2020, while Carrollton is expected to grow at a rate of 15 to 19 percent per decade. All the other areas included in the population wheels are expected to grow at less than 10 percent per decade (Table 2.2-2).

Table 2.2-2
Population Rates

Counties	1970 to 1980	1980 to 1990	1990 to 2000	2000 to 2010	2010 to 2020
Carroll*	0.86%	1.84%	1.26%	- 0.24%	-2.07%
Carrollton	18.00%	19.02%	18.58%	17.28%	15.81%
Owen	1.74%	2.63%	5.13%	3.66%	3.53%
Gallatin	18.53%	24.49%	22.95%	24.00%	24.73%
Switzerland	9.9%	3.6%	2.9%	-	- **

* Not including Carrollton.

** Switzerland County Projection data not available for the years 2010 and 2020.

Table 2.2-1

Population Estimates and Projections 1970 through 2000 Within 0-10 Miles of Ghent Station

Radius	1970	1980	1990	2000
0-1 mile	1,172	1,269	1,303	1,339
1-2 miles	1,320	1,403	1,452	1,490
2-3 miles	340	363	386	410
3-4 miles	495	541	595	654
4-5 miles	626	677	731	793
0-5 miles	3,953	4,253	4,467	4,686
6-10 miles	12,097	13,617	15,296	17,293
Total	16,050	17,870	19,813	21,979

Note: Complete annular ring projections available only to year 2000.

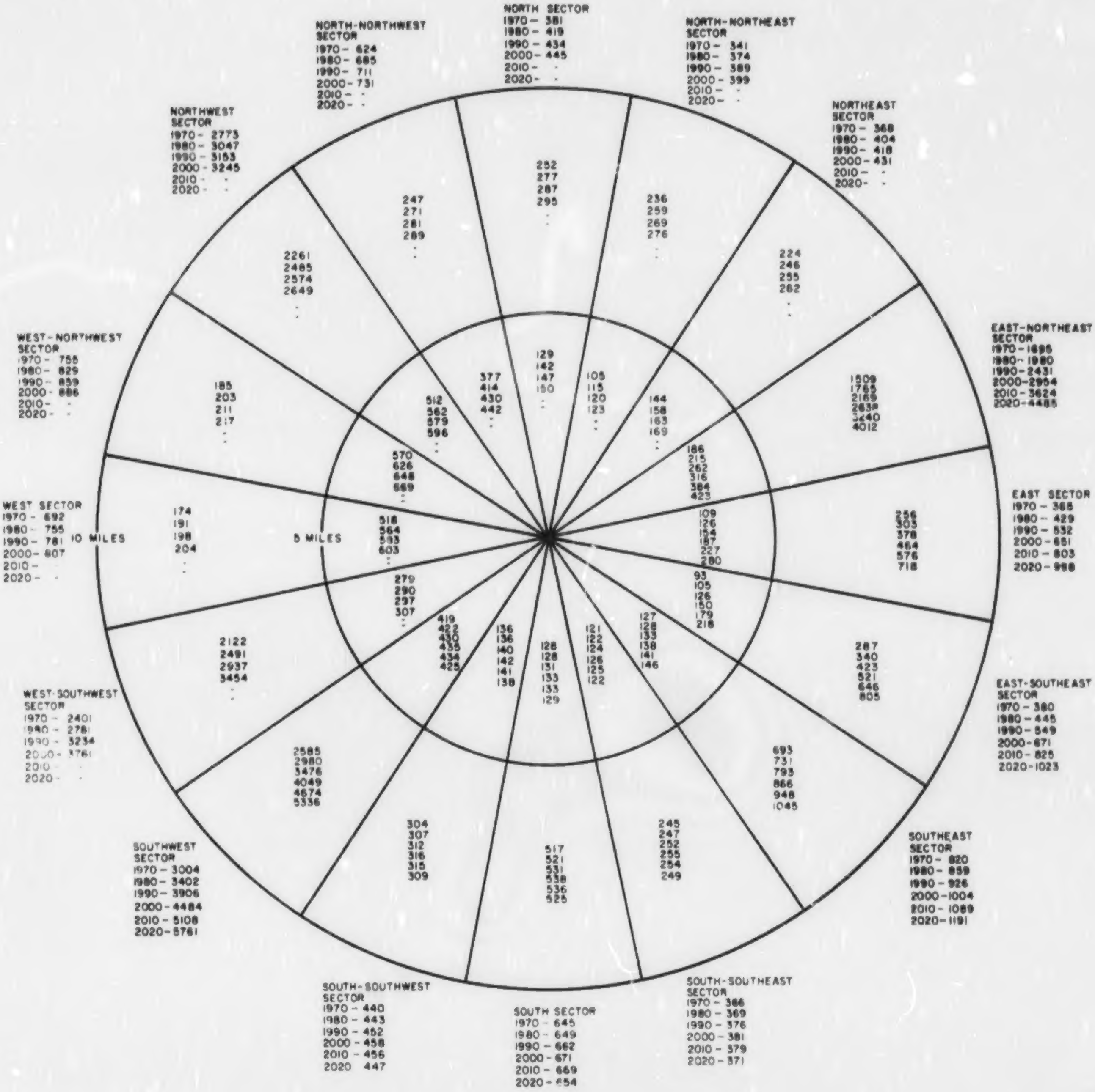
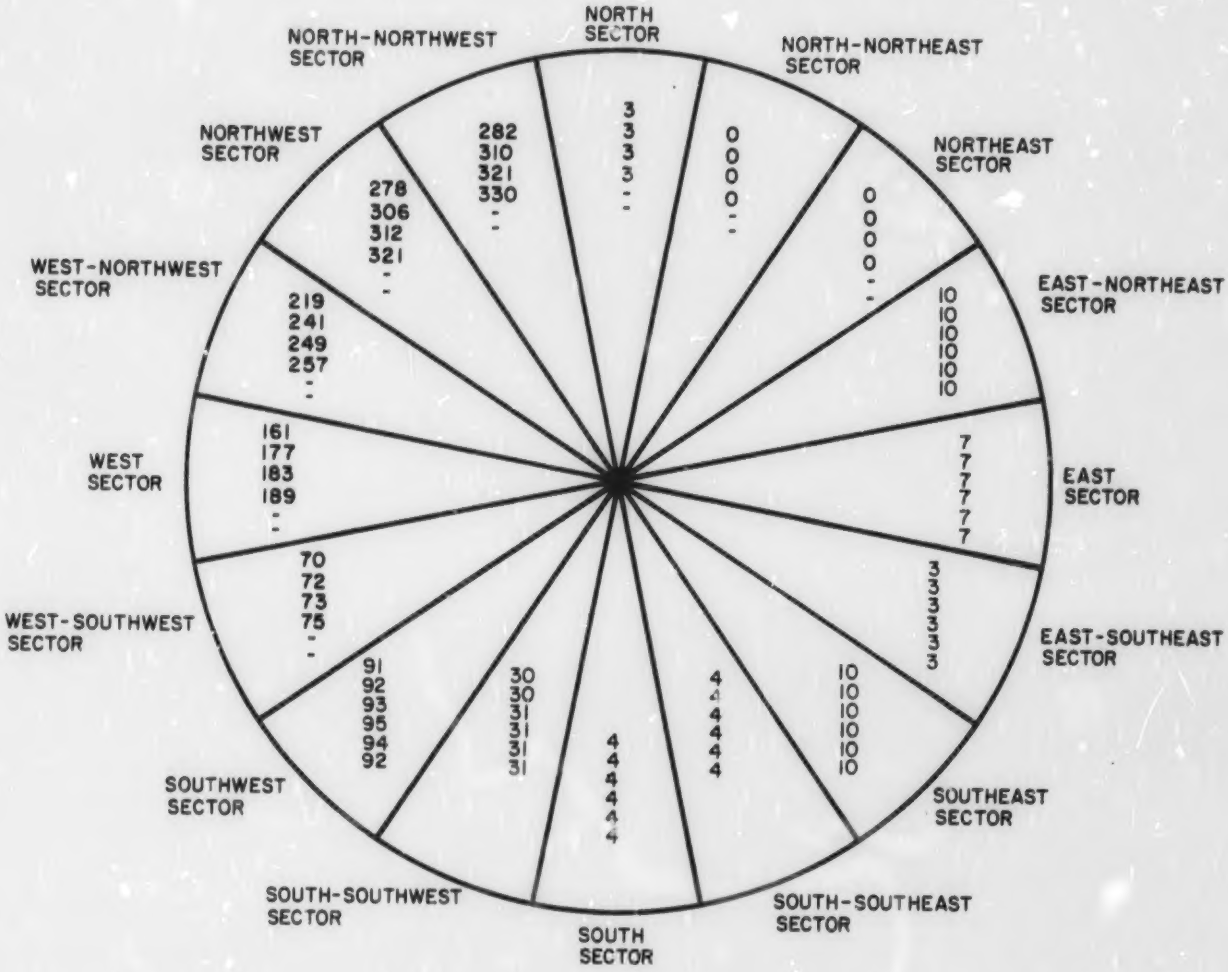


Figure 2.2-3. Zero to 10-mile population estimates and projections.

Note: Circles are drawn with the Ghent Station as center.



0-1 MILE
INSERT

Figure 2.2-2a. Zero to 1-mile population estimates and projections.

Note: Circles are drawn with the Ghent Station as center.

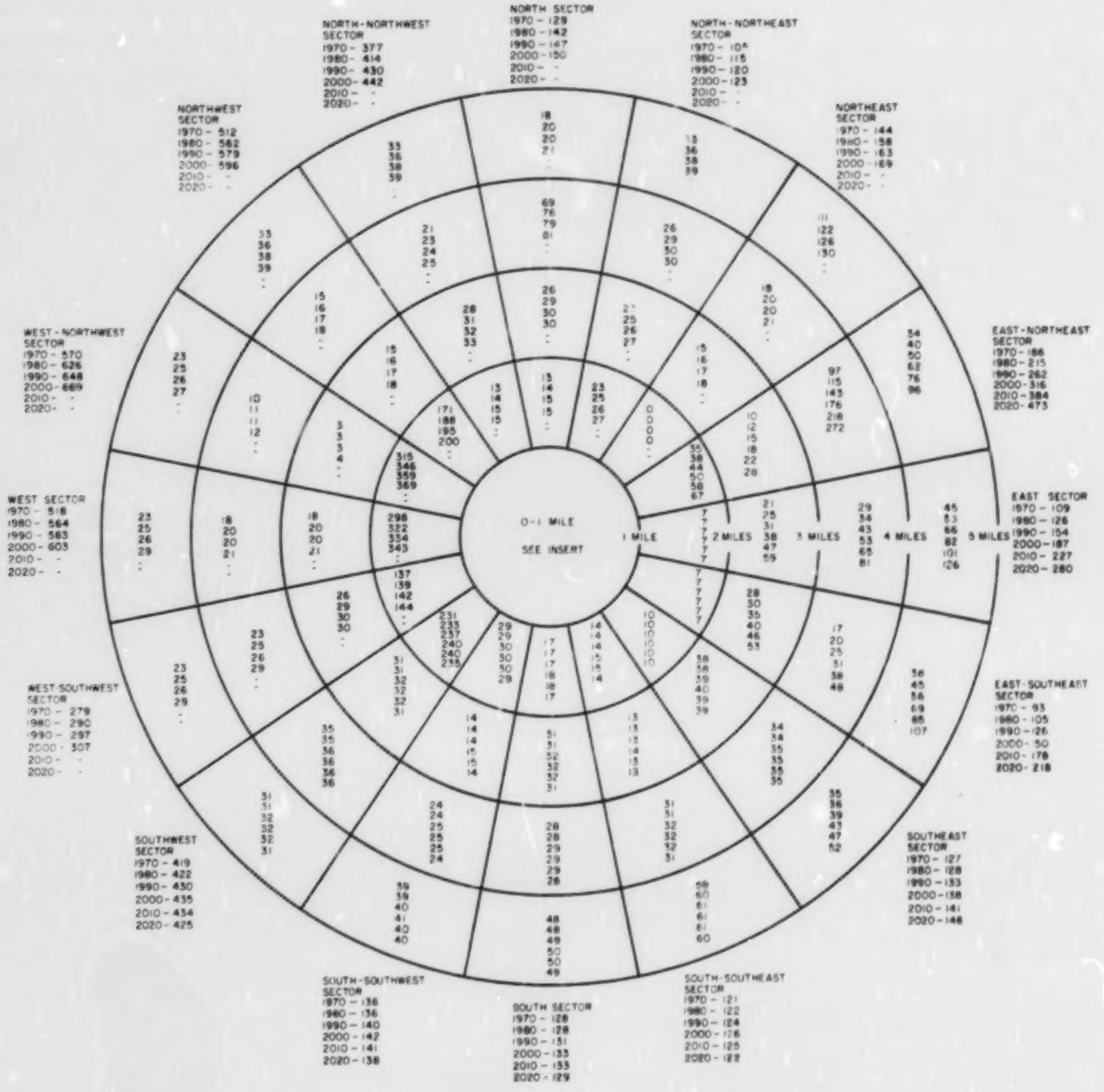


Figure 2.2-2. Zero to 5-mile population estimates and projections.

Note: Circles are drawn with the Ghent Station as center.

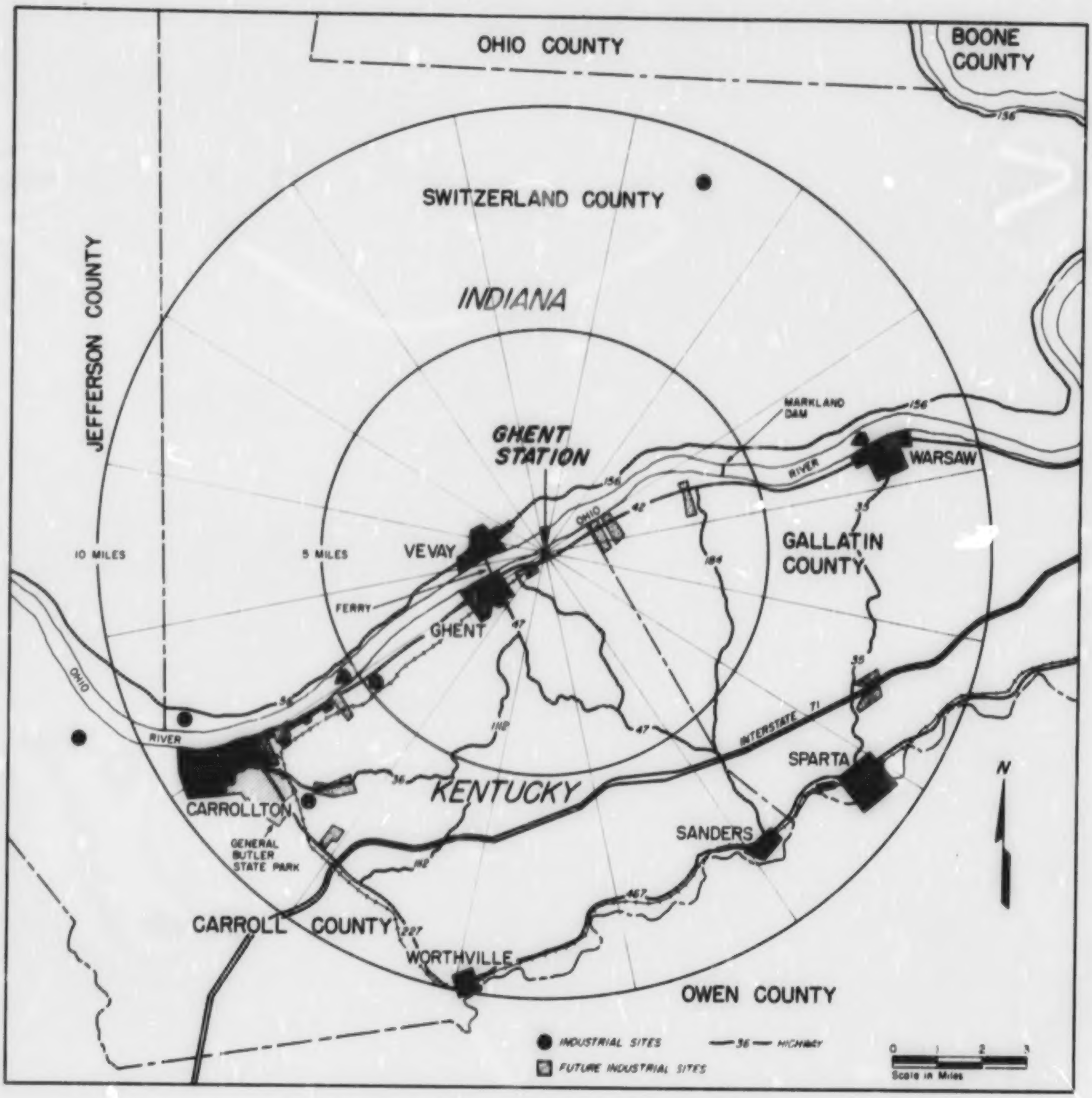


Figure 2.2-1. Orientation map of study area.

2.2 MAN-MADE ENVIRONMENT

2.2.1 Population

Potential demographic changes associated with regional socio-economic and plant emission impacts will be limited largely to the area within 10 miles of the Ghent Power Station. Particular emphasis is given to the area within a 5 mile radius because it has been shown that maximum concentrations of plant emissions will be limited to this area (see Section 2.1.2).

Figure 2.2-1 is an orientation map of the study area within a 10 mile radius of the plant; the major population centers are indicated. This area covers a major portion of Carroll County and parts of Gallatin and Owen Counties on the Kentucky side of the Ohio River. On the Indiana side of the Ohio River, the area covers a major portion of Switzerland County and a small part of Jefferson County. There are several small towns shown on the orientation map. Ghent, Kentucky, and Vevay, Indiana, are within 2 miles of the plant, while other towns of Carrollton, Prestonville, Sanders and Warsaw, Kentucky, are from 6 to 10 miles from the plant.

2.2.1.1 Present and Projected Populations

Present and projected populations are illustrated by populations wheels that are divided into 16 directional sections and present first the 1970 census populations and then projected populations in 10-year increments through the year 2020. (For methododology used in projecting populations, see Section 2.2.1.1A).

Figures 2.2-2 and 2.2-2a present the populations zero to 5 miles from the plant in 1-mile increments and Figure 2.2-3 presents the populations zero to 10 miles from the plant in 5-mile increments. The annular ring totals are given in Table 2.2-1.

Based on house counts from 1970 enumeration district maps, the population within a 5-mile radius was 3,953 people, and is projected to increase to approximately 4,686 people by the year 2000. Most of this population resides in the towns of Ghent (385) and Vevay (1,473). The population of the area within a 10-mile radius, based on 1970 enumeration district maps, was 16,050 including the additional popula-

2.1.5.6 Aquatic Macrophytes

Due to the channelization and increased utilization of the Ohio River for transportation, the abundance and relative importance of aquatic macrophytes has decreased significantly in the past several decades, as compared to the other components of the aquatic food web. Public Service Indiana found only one 0.27 acre zone of aquatic macrophytes at R.M. 570 which consisted of 1 species, horned pond weed (*Zannichellia pulutris*).

Table 2.1-30 (cont'd)

Benthic Taxa Collected At The Marble Hill Site
1974-1975

TAXA

- ARTHROPODA
  - MOLLUSCA
    - GASTROPODA
      - *Pleurocera acuta*
      - *Amnicola sp.*
      - *Physa sp.*
    - PELECYPODA
      - *Corbicula manilensis*
      - *Pisidium sp.*
      - *Sphaerium sp.*

Source: Public Service Indiana 1975.

Table 2.1-30

Benthic Taxa Collected At The Marble Hill Site
1974-1975

TAXA

- PLATYHELMINTHES
  - TURBELLARIA
- ANNELIDA
  - OLIGOCHAETA
    - NAIDIDAE
      - *Nais variabilis*
    - TUBIFICIDAE
      - *Limnodrilis cervix*
      - *L. cervix var.*
      - *L. hoffmeisteri*
      - *L. spiralis*
      - *L. udekemianus*
      - *L. maumeensis*
      - *L. claparedianus*
      - *Branchiura sowerbyi*
      - *Ilyodrilus templetoni*
      - Immature with capilliform chaetae
      - Immature without capilliform chaetae
  - HIRUDINEA
    - EPOBDELLIDAE
      - *Erpobdella punctata*
- ARTHROPODA
  - CRUSTACEA
    - ISOPODA
      - *Lirceus sp.*
    - AMPHIPODA
      - *Gammarus sp.*
      - *Crangonyx sp.*
  - INSECTA
    - DIPTERA
      - CHIRONOMIDAE
        - *Cryptochironomus sp.*
        - *Paracladopelma sp.*
        - *Coelotanypus sp.*
        - *Tricho cladius sp.*
        - *Concha pelopia sp.*
        - *Procladius sp.*
        - *Larsia sp.*

- INSECTA
  - DIPTERA
    - CHIRONOMIDAE (cont'd)
      - *Stictochironomus sp.*
      - *Microtendipes sp.*
      - *Phaenopsectra sp.*
      - *Dicrotendipes modestus*
      - *Xenochironomus sp.*
      - *Ablabesmyia sp.*
      - *Glyptotendipes sp.*
      - *Kiefferulus sp.*
      - *Chironomus sp.*
      - *Rheotanytarsus sp.*
      - *Calopsectra sp.*
      - *Endochironomus sp.*
      - *Paratendipes sp.*
      - *Cricotopus sp.*
      - *Polypedilum sp.*
      - *Cardiocladius sp.*
      - *Orthocladius sp.*
      - *Micropsectra sp.*
      - *pupae*
    - CERATOPOGONIDAE
    - SIMULIIDAE
      - *Prosimulium sp.*
  - TRICHOPTERA
    - *Cheumatopsyche sp.*
    - *Neophylax sp.*
    - *Neureclipsis sp.*
    - *Oecetis sp.*
    - *Diplectrona sp.*
  - PLECOPTERA
    - *Leuctra sp.*
    - *Neoperla sp.*
  - EPHEMEROPTERA
    - *Hexagenia sp.*
    - *Potamanthus sp.*
  - COLEOPTERA
    - *Psephenus sp.*
  - MEGALOPTERA
    - *Chauliodes sp.*

The diatom *Gomphonema olivaceum* dominated the April samples with *Achnanthes lanceolata, Navicula virdula var. avenacea, Nitzschia dissipata and Surirella ovata* present to a lesser degree. August, in which the largest total abundance was noted, demonstrated a shift in species composition with the dominant organisms being the diatoms, *Achnanthes lanceolata and Cocconeis placentula* and the blue-green alga *Phormidium sp., C. placentula* was the single most abundant species.

October samples showed *Cocconeis placentula* dominating as in August except in lower abundance. *Achnanthes lanceolata, Gomphonema parvulum and Navicula graciloides* were also present in substantial numbers.

December samples showed a species composition similar to October's except lower abundance, probably due to increasing river discharge, lower temperatures and decreasing transparency of the water.

2.1.5.5 Benthic Organisms

Benthic organisms are a group of aquatic organisms associated with bottom substrates. Some of these organisms spend their entire lives in the aquatic environment, but the majority have a terrestrial phase. All serve as important links in the transfer of energy in the aquatic ecosystem. Benthos such as stoneflies, mayflies, caddisflies and midges convert detritus into forms usable by other animals in the food web. Others utilize such sources as periphyton, drifting heterogeneous material, other aquatic organisms or small fish, fry, or fingerlings (Forbes 1925; Hynes 1960; Usinger 1956).

Benthos were sampled at various stations near R.M. 570 on the Ohio River by Public Service Indiana from March 1974 to February 1975. Samples included species presented in Table 2.1-30. Aquatic worms (Oligochaeta) and other pollution tolerant or facultative species dominated collections from the Ohio River. Other less pollution tolerant species such as mayfly, stonefly, and caddisfly larvae were also collected. Other abundant organisms collected include the amphipod *Crangonyx* and the isopod *Lirceus*, both facultative genera. In the early spring, before emergence of other aquatic forms, a very diverse chironomid fauna was collected.

Table 2.1-29 (cont'd)

Cumulative Taxonomic List Of Periphyton Algae
April 1974 Through February 1975
All Marble Hill Sampling Stations

CHLOROPHYTA (cont'd)

- *Closterium moniliforum*
- *Closterium sp.*
- *Cosmarium botrytis*
- *Pseudoulvella americana*
  - *Stigeoclonium sp.*

CYANOPHYTA

- *Lyngbya sp.*
- *Microcystis sp.*
- *Oscillatoria tenuis*
- *Phormidium sp.*

Source: Public Service Indiana 1975.

Table 2.1-29

Cumulative Taxonomic List Of Periphyton Algae
April 1974 Through February 1975
All Marble Hill Sampling Stations

BACILLARIOPHYTA

CENTRALES

Coscinodiscus lacustris
Cyclotella menghiniana
C. pseudostelligera
Melosira ambigua
M. distans
M. granulata
M. granulata var. angustissima
M. varians
Stephanodiscus hantzschii

PENNALES

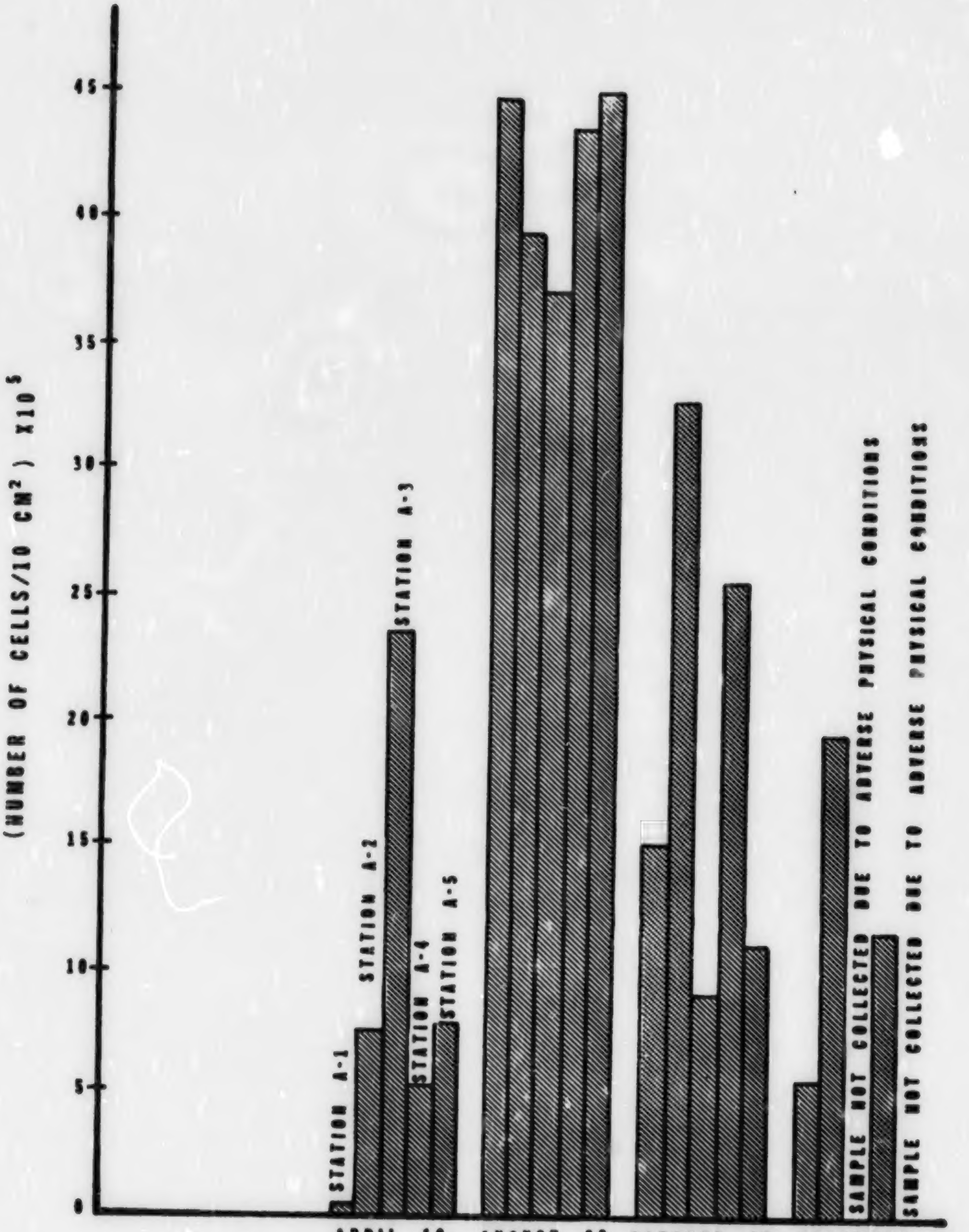
Achnanthes exigua
A. lanceolata
A. minutissima
Amphipleura lindheimeri
Amphora ovalis
A. ovalis var. pediculus
A. normani
Caloneis bacillum
C. ventricosa
Capartogramma crucicula
Cocconeis pediculus
C. placentula
Cymbella sinuata
C. tumida
C. ventricosa
Diatoma tenue
D. tenue var elongatum
D. vulgare
Fragilaria vaucheriae
Gomphonema abbreviatum
G. lanceolatum
G. olivaceum
G. parvulum
Gyrosigma scalproides
Hantzschia amphioxys
Meridion circulare
Navicula capitata
N. cryptocephala
N. cryptocephala var. veneta

PENNALES (cont'd)

N. graciloides
N. integra
N. menisculа
N. minima
N. mutica
N. pelliculosa
N. pupula
N. radiosa
N. radiosa var. tenella
N. sanctaecrucis
N. symetrica
N. tenera
N. tripunctata
N. tripunctata var. schizonemoide
N. viridula
N. viridula var. avenacea
Nitzschia acicularis
N. amphibia
N. apiculata
N. dissipata
N. filiformis
N. fonticola
N. linearis
N. palea
N. paradoxa
N. punctata
N. sublinearis
N. tryblionella
N. tryblionella var. victoriae
N. vermicularis
Pinnularia borealis
Rhoicosphenia curvata
Surirella angustata
S. ovata
Synedra minuscula
S. pulchella
S. ulna

CHLOROPHYTA

Cladophora spp.
Closterium eboracense



Source: Public Service Indiana 1975.

Figure 2.1-17. Periphyton Standing Crop Values at Ohio River Stations A-1 through A-5, Marble Hill Site, April through December 1974.

the October samples. One species of rotifer, *Keratella cochlearis* was found on all 4 dates, as were Nauplii, the juvenile form of copepods. Three species of adult copepods and 5 species of cladocerans were collected during the study. *Cyclops sp., Diaptomus sp.* and a Harpacticoid species were the copepods found. The cladocerans found were *Bosmina longirostris, Chydorus sp., Daphnia sp., Eubosmina longispina and Sida crystallina.*

Zooplankton populations are recognized to be highly variable and subject to radical and sudden fluctuations in density (Pennak 1946). The populations examined in these studies were most abundant in spring and summer and scarce in winter, showing seasonal highs and lows.

2.1.5.4 Periphyton

Periphyton, or algae which are normally attached to submerged objects, have been studied at river miles 570 and 496 (Public Service Indiana 1975). Masses of cells may occur as thin films on mud, silt or plant surfaces receiving sufficient light. Although the periphyton community is more stable than the phytoplankton community, it is subject to seasonal variations due to hydrographic factors. During periods of flooding, increased abrasion may loosen the periphyton from its substrate causing it to become a major part of the phytoplankton community (Butcher 1932).

Public Service of Indiana found in studies carried out quarterly between June 1974 and February 1975, that the periphyton community consisted of 86 species from 3 algal divisions, Bacillariaphyta (diatoms), Chlorophyta (green algae) and Cyanophyta (blue-green algae). Total periphyton populations ranged from a low of 1.3×10^6 cells per 10 cm^2 in April 1974 to a high of 4.5×10^6 cells per 10 cm^2 in August 1974 (Figure 2.1-17). Diatoms dominated all samples in both total species and abundance and comprised between 86 and 100 percent of all organisms identified and counted. Table 2.1-29 presents a species list of the periphyton algae collected April 1974 through February 1975.

Table 2.1-28

Cumulative Taxonomic List of Zooplankton
March 1974 Through February 1975
Marble Hill Sampling Locations

TAXA

ARTHROPODA

CRUSTACEA

COPEPODA

Nauplii
Calanoid copepodite
Cyclopoid copepodite
Harpacticoid copepodite
Cyclops bicuspidatus thomasi
C. vernalis
Diaptomus ashlandi
D. oregonensis
D. pallidos
D. sicilis
D. siciloides
Eucyclops agilis
Macrocyclops albidus

CLADOCERA

Alona guttata
Bosmina longirostris
Ceriodaphnia quadrangula
Chydorus sphaericus
Daphnia ambigua
D. galeata mendotae
D. parvula
D. retrocurva
Diaphanosoma brachyurum
Ilyocryptus spinifer
Moina affinis

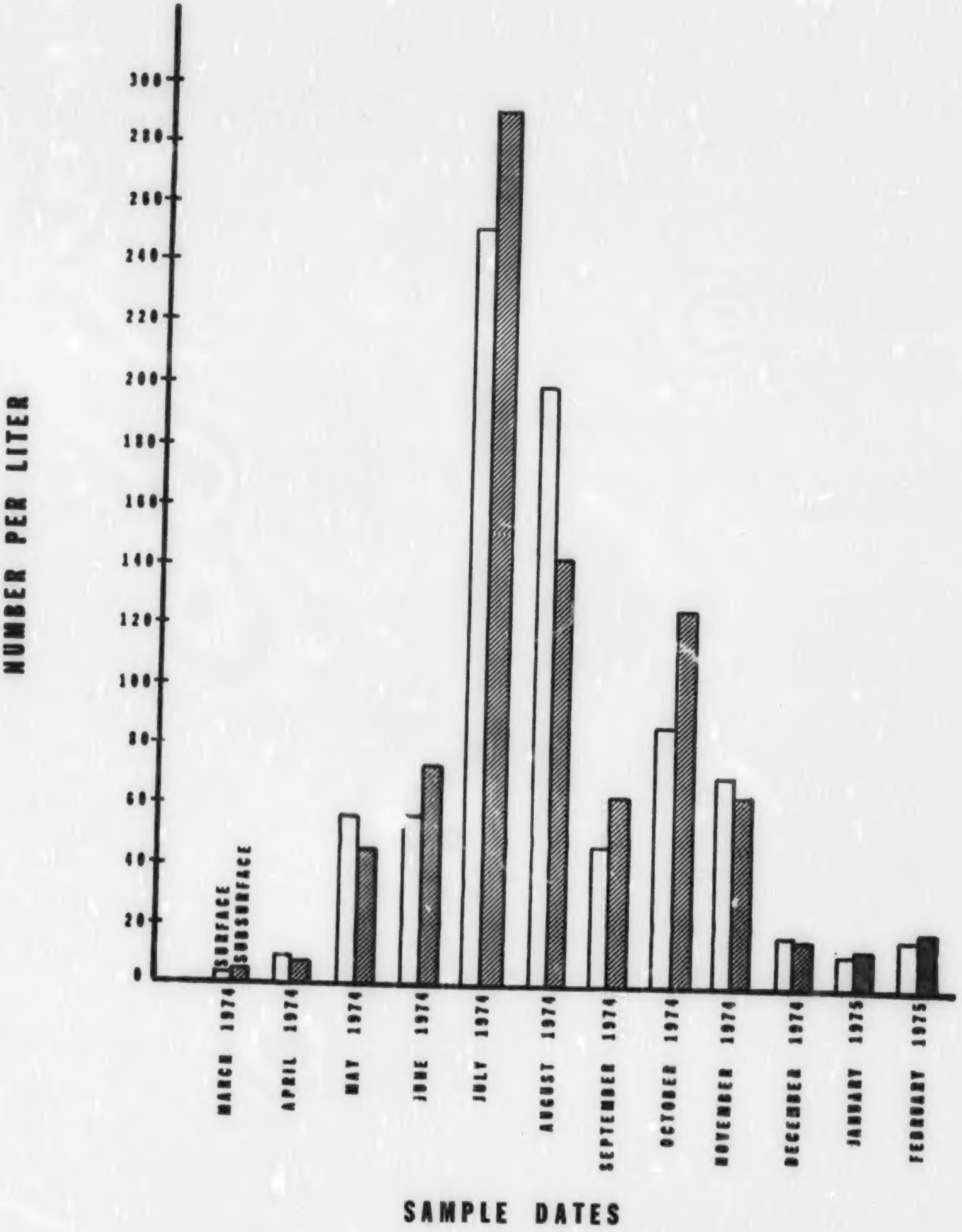
ROTIFERA

Asplanchna priodanta
Brachionus angularis
B. bidentata
B. budapestinensis
B. calyciflorus
B. caudatus
B. havaniensis
B. quadridentata

ROTIFERA (cont'd)

B. urceolaris
Cephalodella sp.
Chromogaster ovalis
Conochilus sp.
Conochiloides sp.
Euchlanis dilatata
Filinia longiseta
Gastropus stylifer
Hexarthra sp.
Kellicottia bostoniensis
K. longispina
Keratella cochlearis
K. quadrata
K. serrulata
K. valga
Lecane bulla
Lecane sp.
Lepadella patella
Notholca acuminata
Platyias patulus
Pleosoma truncatum
Pompholyx
Solcata
Polyarthra sp.
Rotaria sp.
Synchaeta pectinata
S. stylata
Synchaeta sp.
Testudinella patina
Trichocerca sp.
Trichotria tetractis

Source: Public Service Indiana 1975.



Source: Public Service Indiana 1975.

Figure 2.1-16. Average Numbers of Zooplankton Collected at the Five Ohio River Sampling Locations.

Table 2.1-27 (cont'd)

Cumulative Species List From Samples Taken From The Ohio River Stations A-1 Through A-6 During The Period From March 1974 To February 1975 Marble Hill Site

CHLOROPHYTA (cont'd)

- *Scenedesmus sp-1*
- *Scenedesmus sp-2*
- *Schroederia setigera*
- *Selanastrum sp.*
- *Sphaerocystis sp.*
- *Staurastrum sp.*
- *Stigeoclonium sp.*
- *Tetraedron caudatum var. incisum*
- *Tetrastrum heterocanthum*
- *Tetrastrum sp.*

CHRYSOPHYTA

- *Chrysococcus sp.*
- *Dinobryon sertularia*
- *Dinobryon sp.*
- *Lagynion sp.*

CYANOPHYTA

- *Anabaena sp.*
- *Chroococcus sp.*
- *Coelosphaerium sp.*
- *Merismopedia sp.*
- *Microcystis sp.*
- *Oscillatoria sp-1*
- *Oscillatoria sp-2*
- *Rhaphidiopsis curvata*
- *Rhaphidiopsis sp.*

EUGLENOPHYTA

- *Euglena sp.*
- *Phacus sp.*
- *Strombomonas sp.*
- *Trachelomonas sp.*

PYRROPHYTA

- *Cryptomonas sp.*
- *Peridinium sp.*

Source: Public Service Indiana 1975.

Table 2.1-27 (cont'd)

Cumulative Species List From Samples Taken From The Ohio River Stations A-1 Through A-6 During The Period From March 1974 To February 1975 Marble Hill Site

BACILLARIOPHYTA (cont'd)

PENNALES

N. vermicularis
Nitzschia spp.
Pinnularia appendiculata
P. braunii
P. brebissonii var. diminuta
P. mesolepta
P. microstauron
P. subcapitata
Pinnularia spp.
Rhoicosphenia curvata
Stayroneis anceps
S. smithii
Stauroneis sp.
Surirella angustata
S. biseriata
S. ovalis
S. ovata
S. variabilis
Surirella spp.
Synedra acus
S. delicatissima
S. delicatissima var. angustissima
S. fasciculata
S. incisa
S. parasitica var. subconstricta
S. pulchella
S. rumpens
S. rumpens var. familaris
S. rumpens var. meneghinana
S. socia
S. ulna
S. ulna var. ramsei
Synedra spp.
Tabellaria fenestrata
T. flocculosa

CHLOROPHYTA

Actinastrum hantzschii
Actinastrum sp.
Ankistrodesmus convolutus

CHLOROPHYTA (cont'd)

A. falcatus
Characium sp.
Chlamydomonas sp-1
Chlamydomonas sp-2
Chodatella sp.
Cladophora sp.
Closterium sp.
Coelastrum sp.
Crucigenia apiculata
C. quadrata sp.
C. tetrapedia
Crucigenia sp.
Dictyosphaerium pulchellum
Dictyosphaerium sp.
Draparnaldia sp.
Elakatothrix so.
Eurastrum sp.
Golenkinia sp.
Kirchneriella lunaris
Micractinium pusillum
Micractinium sp.
Monoraphidium sp.
Mougeotia sp.
Oocystis lacustris
Oocystis sp.
Pandorina morum
Pandorina sp.
Pediastrum duplex
P. simplex
P. tetras
Quadrigula sp.
Scenedesmus abundans
S. acuminatus
S. arcuatus
S. carnatus
S. opoliensis
S. protruberans
S. quadricauda
S. quadricauds var. alternans
S. smithii
S. spinosus

Table 2.1-27 (cont'd)

Cumulative Species List From Samples Taken From The Ohio River Stations A-1 Through A-6 During The Period From March 1974 To February 1975 Marble Hill Site

BACILLARIOPHYTA (cont'd)

PENNALES

Gomphohema olivaceum
G. parvulum
G. sphaerophorum
G. turris
Gomphonema sp-1
Gomphonema sp-2
Gomphonema sp-3
Gyrosigma accuminatus
G. attenuatum
G. obtusum
G. scalproides
Hannea arcus
Hannea sp.
Hantzschia amphioxys
Meridion circulare
Navicula accomoda
N. bicapitellata
N. capitat
N. cryptocephala
N. cryptocephala var. avenacea
N. cryptocephala var. veneta
N. cuspidata
N. decussis
N. elginensis
N. exigua
N. graciloides
N. hustedtl
N. lanceolata
N. longirostrus
N. menisculus var. upsaliensis
N. minima
N. mutica
N. pseudoreinhardtii
N. pupula
N. pupula var. mutica
N. pygmea
N. radiosa
N. rhyncocephala
N. rhyncocephala var. amphiceros
N. salinarum

PENNALES (cont'd)

N. schroeteri
N. secura
N. symmetrica
N. tenera
N. tripunctata
N. tripunctata var. schizonemoides
N. viridula
N. viridula var. avenacea
Navicula sp-1
Navicula sp-2
Nitzschia acicularis
N. actinastroides
N. acuta
N. affinis
N. amphibia
N. apiculata
N. capitellata
N. clausii
N. closterium
N. dissipata
N. filiformis
N. fonticola
N. frustulum
N. hungarica
N. lanceolata
N. linearis
N. lorenziana var. subtilis
N. microcephala
N. palea
N. paleacea
N. parvula
N. paradoxa
N. romana
N. sigma
N. sigmoidea
N. sinuata var. tabellaria
N. subcohaereus
N. sublinearis
N. thermalis
N. triblionella
N. triblionella var. victoriae

Table 2.1-27

Cumulative Species List From Samples Taken From The Ohio River Stations A-1 Through A-6 During The Period From March 1974 To February 1975 Marble Hill Site

BACILLARIOPHYTA

CENTRALES

Biddulphia laevis
Coscinodiscus laucustris
C. rothii
Cyclotella atomus
C. comta
C. cryptica - meneghiniana
C. kutzingiana
C. meneghiniana
C. michiganiana
C. ocellata
C. pseudostelligera
C. stelligera
Melosira ambigua
M. distans
M. granulata
M. granulata var. angustissima
M. italica
M. varians
Microsiphona potamos
Stephanodiscus astrea
S. hantzschii
S. invisitatus
S. minutus
S. nigarae
S. subtilis
Stephanodiscus sp.
Thalassiosira fluviatilus
T. psedonana

Achnanthes affinis
A. lanceolata
A. lanceolata var. dubia
A. minutissima
Achnanthes sp.
Amphipleura pellucida
Amphiprora palusida
A. ornata
Amphora ovalis
A. ovalis var. pediculus

PENNALES (cont'd)

A. veneta
Asterionella formosa
Bacillaria paradoxa var. tumidula
Caloneis bacillum
Cocconeis pediculus
C. placentula
C. placentula var. euglypta
C. placentula var. linearis
Cymbella affinis
C. aspera
C. cistula
C. gracilis
C. prostrata
C. turgida
C. ventricosa
Cymbella sp.
Cylindrotheca gracilis
Cymatopleura solea
Diatoma tenue
D. tenue var. elongata
D. vulgare
Epithemia curvata
E. turgida
Eunotia curvata
E. elegans
E. exigua
E. fallax var. fallax
Eunotia sp.
Fragilaria capucina
F. construens
F. crotonensis
F. leptostauren
F. vaucheriae
F. viscerans
Fragilaria spp.
Frustulia rhomboides
F. vulgaris
Gomphonema abbreviatum
G. angustatum
G. constrictum
G. lanceolatum

Non-diatom taxa in the Public Service of Indiana survey ranged from complete absence or very low numbers to a high of 1235 cells/ml in November 1974. Some of the more common species of the green algae included *Actinastrum hantzschii, Ankistrodesmus falcatus, Chlamydomonas sp., Crucigenia quadrata, Dictyosphaerium pulchellum, and Scenedesmus quadricauda. Euglena sp. and Trachelomonas sp.* were euglenoids that were present. Table 2.1-27 presents a cumulative species list of the phytoplankton found in the Public Service of Indiana survey.

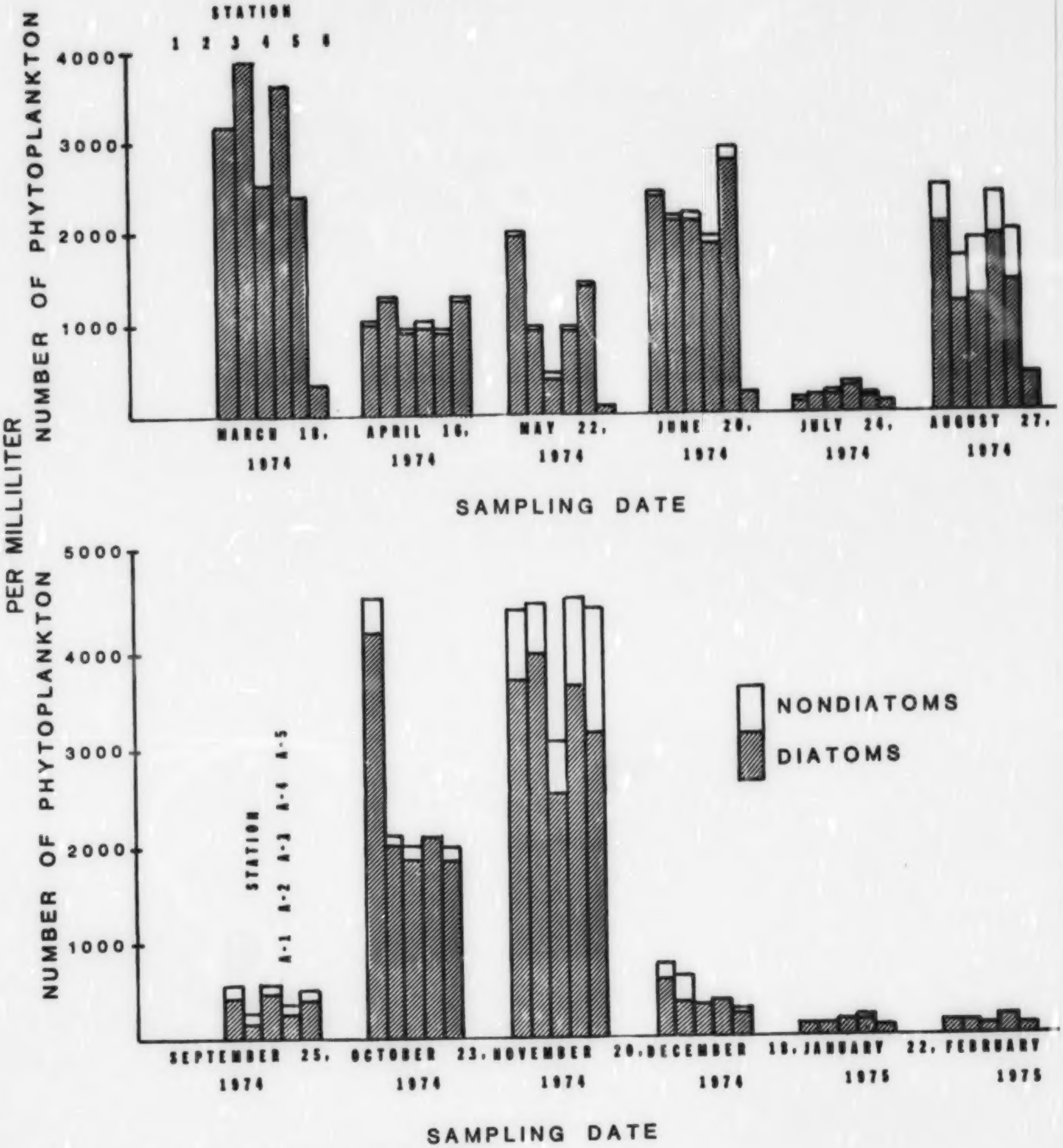
A year long study completed by Wapora (1974) at Tanner's Creek Plant (R.M. 496) demonstrated similar findings. Diatoms dominated the samples throughout most of the year except in the June samples in which the green algae dominated, mainly due to a high number of coccoid greens. Commonly found diatom species included *Cyclotella meneghiniana, Synedra sp., Stephanodiscus sp. and* commonly found greens included *Ankistrodesmus falcatus and Scenedesmus quadricauda.*

2.1.5.3 Zooplankton

The zooplankton community, which includes cladocerans, copepods, rotifers and protozoans, is a main link between the primary producers and secondary consumers in river systems. The importance of zooplankton as a food source for larger invertebrates and fish is well documented.

Zooplankton populations of the Ohio River, as surveyed by Public Service Indiana (1975) at R.M. 570, included 9 species of copepods, 11 species of cladocerans, and 38 species of rotifers. Total zooplankton abundance ranged from a low of 2 organisms per liter in March 1974 to a high of 441 organisms per liter in July 1974 (Figure 2.1-16). In May, rotifers were dominant with the dominant species being *Brachionus calyciflorus and Keratella cochlearis.* Rotifers were also dominant in June with major genera being *Keratella, Pleosoma and Synchaeta. Moina affinis* and the rotifers *Synchaeta and Keratella* and the protozoa *Codonella* were also numerous in most samples. Table 2.1-28 is a species list of the zooplankton found during the year study.

Wapora (1974) had similar findings at the Tanner's Creek Plant, R.M. 496. Rotifers dominated the June, November and July samples and cladocerans were dominant in



Source: Public Service Indiana, 1975.

Figure 2.1-15. Cumulative Phytoplankton Distribution for Ohio River and Tributary Stream Sampling Locations.

Table 2.1-26 (cont'd)

Summary Of Egg And Fry Tows
Tanners Creek
16 June 1974

Location of Tow	Taxonomic Group	Size Range (mm)	Number of Fish	Number of Liters Sampled	Number of Fish per 10^3 Liters
Above	No specimens			20685.8	0
Above	CYPRINIDAE	9	1	25072.3	0.4
		7	1		0.4
Below	CYPRINIDAE	6	1	17881.1	0.6
	CLUPEIDAE	5	1		0.1
Below	No specimens			20391.8	0
Great Miami River	CYPRINIDAE	11	1	24149.2	0.4
	CLUPEIDAE	16	2		0.8
Great Miami River	No specimens			16140.6	0
Great Miami River	No specimens			23073.1	0
Great Miami River	CLUPEIDAE	7	1	12348.0	0.8
	CYPRINIDAE	9	1		0.8
	CYPRINIDAE	5	1		0.8

Source: Wapora 1974.

Table 2.1-26

Summary Of Egg And Fry Tows
Tanners Creek
20-21 May 1974

Location of Tow	Taxonomic Group	Size Range (mm)	Number of Fish	Number of Liters Sampled	Number of Fish per 10^3 Liters
Upstream	No specimens			25042.9	0
Upstream	CLUPEIDAE (Herring)	6	1	31093.4	0.3
	CYPRINIDAE (Minnows)	5	14		4.5
	Egg-sac Fry	4	1		0.3
Discharge	CYPRINIDAE	7	10	6350.4	15.7
	CLUPEIDAE	7	2		3.1
	Egg	3	1		1.6
Discharge	CYPRINIDAE	14.5	1	13312.3	0.8
		7	1		0.8
		5	9		6.8
	CLUPEIDAE	6	1		0.8
	Egg-sac Fry	4	3		2.3
Discharge	CYPRINIDAE	5	23	24531.4	9.4
	CYPRINIDAE (Egg-sac Fry)	4	1		0.4
	CLUPEIDAE	7	1		0.4

Source: Wapora 1974.

Table 2.1-25 (cont'd)

Fish Larvae Collected by Tow Net at Five Sampling Points
Marble Hill Site, March 18 to July 31, 1974

DATE	TAXON	TOTALS
July 17	CYPRINIDAE	
	Cyprinus carpio	30
	Other minnows	13
	CLUPEIDAE	6
	SCIAENIDAE	
	Aplodinotus grunniens	968
	CENTRARCHIDAE	
	Lepomis sp.	1
	Total Larvae	1018
July 25	CYPRINIDAE	8
	CLUPEIDAE	1
	SCIAENIDAE	
	Aplodinotus grunniens	9
	Unidentifiable	2
	Total Larvae	20
July 31	CLUPEIDAE	70
	SCIAENIDAE	
	Aplodinotus grunniens	23
	CENTRARCHIDAE	
	Lepomis sp.	3
	Total Larvae	96

Source: Public Service Indiana 1975.

Table 2.1-25

Fish Larvae Collected by Tow Net at Five Sampling Points Marble Hill Site, March 18 to July 31, 1974

DATE	TAXON	TOTALS
March 18		0
March 27		0
April 5		0
April 10		0
April 19		0
April 28	PERCIDAE	
	Stizostedion sp.	1
	Stizostedion vitreum	1
	Total Larvae	2
May 7	CYPRINIDAE	3
	CATOSTOMIDAE	9
	PERCIDAE	
	Stizostedion sp.	1
	POLYODONTIDAE	
	Polyodon spathula	1
	ESOCIDAE	
	Esox sp.	1
	Total Larvae	15
May 12	CYPRINIDAE	
	Cyprinus carpio	1
	Other minnows	7
	CATOSTOMIDAE	15
	SCIAENIDAE	
	Aplodinotus grunniens	1
	Total Larvae	24
May 24		0
May 29		0
May 30		0
June 6		0
June 12	CYPRINIDAE	
	Cyprinus carpio	3
	Other minnows	30
	CLUPEIDAE	2
	Unidentifiable	3
	Total Larvae	38

Public Service Indiana (1975) reported that no fish eggs or larvae were collected until the river temperature exceeded 12.5C (54.5F) after April 19, 1974. After this date until July 31, 1974, a total of 510 fish eggs and 1213 fish larvae were collected. Samples collected on July 17 contained the greatest number of fish larvae with freshwater drum accounting for 95 percent of the 1018 larvae collected (Table 2.1-25).

Wapora (1974) performed fish eggs and larvae survey on April 3-6, May 20-21, June 16 and August 14, 1974. Specimens were found only in the May and June samples. All the specimens identified belonged to the herring (Clupeidae) or minnow (Cyprinidae) families. Densities ranged from 0 to 15.7 larvae per cubic meter (Table 2.1-26).

2.1.5.2 Phytoplankton

The composition of the phytoplankton community of the Ohio River, like most rivers, is changeable and dependent upon river temperature, flow and nutrient load. For this, reason only general statements can be made concerning population density and species make-up for the Ohio River at the Ghent Station.

Public Service Indiana found diatoms to dominate the monthly samples from March 1974 through February 1975. Population densities ranged from under 500 individuals per milliliter in December, January and February to over 4000 individuals per milliliter in November (Figure 2.1-15).

Centric diatoms comprised the majority of diatoms from May through November 1974 in the Public Service Indiana survey. Centric diatoms included *Cyclotella atomus, C. meneghiniana, Melosira ambigua, M. distans, and M. granulata* which are generally found in eutrophic water (Lowe 1974). During periods of lower water temperature and greater discharge (March and April 1974, December 1974 through February 1975), pennate diatoms, most of which are periphytic, comprised the majority of the planktonic diatoms. The most common pennate diatoms included *Cocconeis placentula, Fragilaria crotonensis, Gomphonema olivaceum, G. parvulum, Navicula cryptocephala, N. tripunctata and N. viridula.*

Table 2.1-24

Reported Spawning Temperatures Of Fourteen Species Of Fish Common To The Ohio River At Marble Hill

Common Name	Scientific Name	Reported Spawning Temperature C	F	Source
Longnose gar	*Lepisosteus osseus*	20-30	68-86	Taber, 1969
Gizzard shad	*Dorosoma cepedianum*	10-21	50-70	Miller, 1960
Carp	*Cyprinus carpio*	15-30	59-86	Breder and Rosen, 1966
Emerald shiner	*Notropis atherinoides*	22	72	Flittner, 1964
River carpsucker	*Carpiodes carpio*	19.4-23.9	67-75	Jester, 1972
White sucker	*Catostomus commersoni*	6-23	43-73	Mansuetti and Hardy, 1967
Shorthead redhorse	*Moxostoma macrolepidotum*	11	52	Mansuetti and Hardy, 1967
Channel catfish	*Ictalurus punctatus*	21.1-29.4	70-85	Clemens and Sneed, 1957
White bass	*Morone chrysops*	15.6	60	Breder and Rosen, 1966
Bluegill	*Lepomis macrochirus*	19.4-26.7	67-80	Calhoun, 1966
Largemouth bass	*Micropterus salmoides*	17.2-20.0	64-68	Harlan and Speaker, 1956
White crappie	*Pomoxis annularis*	17.8-20.0	64-68	Calhoun, 1966
Sauger	*Stizostedion canadense*	6.1-11.1	43-52	Priegel, 1969
Freshwater drum	*Aplocinotus grunniens*	18	64	Swedberg and Walburg, 1970

Source: Public Service Indiana 1975.

Table 2.1-23

Rare And Endangered Fish Species Of Kentucky

Species	Common Name
Percopsis omiscomaycus (Walbaum)	Trout-perch
Etheostoma asprigene (Forbes)	Mud darter
Etheostoma lustrio (Jordan and Gilbert)	Harlequin darter
Etheostoma tippecanoe (Jordan and Everman)	Tippecanoe darter
Percina macrocephala (Cope)	Longhead darter

Source: U.S. Fish and Wildlife Service 1973.

Table 2.1-22 (cont'd)

Number And Percent Of Relative Abundance Of Fish
16 March 1974 Through 22 January 1975
Marble Hill (R.M. 570)

Common Name	Scientific Name	Totals	Relative Abundance (percent)
Sunfishes	CENTRARCHIDAE		
Rock bass	*Ambloplites rupestris*	1	0.1
Green sunfish	*Lepomis cyanellus*	11	0.7
Pumpkinseed	*L. gibbosus*	1	0.1
Bluegill	*L. macrochirus*	21	1.4
Longear sunfish	*L. megalotis*	1	0.1
Smallmouth bass	*Micropterus dolomieui*	4	0.3
Spotted bass	*M. punctulatus*	11	0.7
Largemouth bass	*M. salmoides*	8	0.5
White crappie	*Pomoxis annularis*	9	0.6
Black crappie	*P. nigromaculatus*	2	0.1
Perches	PERCIDAE		
Rainbow darter	*Etheostoma caeruleum*	2	0.1
Yellow perch	*Perca flavescens*	1	0.1
Sauger	*Stizostedion canadense*	22	1.5
Walleye	*S. vitreum*	7	0.1
Drum	SCIAENIDAE		
Freshwater drum	*Aplodinotus grunniens*	18	1.2
	Totals	1512	100.0

Source: Public Service Indiana 1975.

Table 2.1-22

Number And Percent Of Relative Abundance Of Fish
16 March 1974 Through 22 January 1975
Marble Hill (R.M. 570)

Common Name	Scientific Name	Totals	Relative Abundance (percent)
Gar	LEPISOSTEIDAE		
Longnose gar	*Lepisosteus osseus*	33	2.2
Herrings	CLUPEIDAE		
Skipjack herring	*Alosa chrysochloris*	29	1.9
Gizzard shad	*Dorosoma cepedianum*	499	33.0
Mooneyes	HIODONTIDAE		
Goldeye	*Hiodon alosoides*	8	0.5
Mooneye	*H. tergisus*	1	0.1
Minnows and Carp	CYPRINIDAE		
Goldfish	*Carassius auratus*	1	0.1
Carp	*Cyprinus carpio*	10	0.7
Emerald shiner	*Notropis atherinoides*	601	39.7
Common shiner	*N. cornutus*	1	0.1
Sand shiner	*N. stromineus*	13	0.9
Shiner	*Notropis sp.*	7	0.5
Bluntnose minnow	*Pimephales notatus*	15	1.0
Bullhead minnow	*P. vigilax*	7	0.5
E. Blacknose dace	*Rhinichthys a. atratulus*	91	6.0
Northern Creek chub	*Semotilus atromaculatus*	3	0.2
Suckers	CATOSTOMIDAE		
River carpsucker	*Carpiodes carpio*	27	1.8
White sucker	*Catostomus commersoni*	3	0.2
Smallmouth buffalo	*Ictiobus bubalus*	5	0.3
Bigmouth buffalo	*Ictiobus cyprinellus*	1	0.1
Spotted sucker	*Minytrema melanops*	6	0.4
Redhorse	*Moxostoma sp.*	10	0.7
Catfishes	ICTALURIDAE		
Bluecatfish	*Ictalurus furcatus*	1	0.1
Channel catfish	*Ictalurus punctatus*	11	0.7
Flathead catfish	*Pylodictis olivaris*	1	0.1
Livebearers	POECILIIDAE		
Mosquitofish	*Gambusia affinis*	1	0.1
Temperate bass	PERCICHTHYIDAE		
White bass	*Morone chrysops*	14	0.9

Table 2.1-21

Ohio River Fish Population
Markland Lock And Dam (R.M. 531.5)
30 October 1975

Common Name	Scientific Name	Number	Weight (Kg.)	Range (Cm.)
Herrings	CLUPEIDAE			
Gizzard shad	*Dorosoma cepedianum*	3855	127.51	6-30
Skipjack	*Alosa chrysochloris*	6	0.4	1-25
Minnows and carps	CYPRINIDAE			
Carp	*Cyprinus carpio*	104	299.4	30-66
Suckers	CATOSTOMIDAE			
Smallmouth buffalo	*Ictiobus bubalus*	1	2.1	41
Freshwater catfishes	ICTALURIDAE			
Channel catfish	*Ictalurus punctatus*	311	22.6	21-45
Flathead catfish	*Pylodictus olivardis*	11	0.82	10-20
Temperate basses	PERCICTHYIDAE			
White bass	*Morone chrysops*	10	1.18	11-18
Sunfishes	CENTRARCHIDAE			
Bluegill	*Lepomis macrochirus*	14	1.58	5-19
Spotted bass	*Micropterus punctulatus*	3	0.59	13-24
Largemouth bass	*Micropterus salmoides*	4	3.8	28-33
White crappie	*Pomoxis annularis*	23	8.18	7-28
Black crappie	*Pomoxis nigromaculatus*	1	0.22	19
Longear sunfish	*Lepomis magalotis*	13	1.03	5-15
Rock bass	*Ambloplites rupestris*	1	0.10	13
Perches	PERCIDAE			
Sauger	*Stizostedion canadense*	108	27.54	15-43
Gars	LEPISOSTEIDAE			
Longnose gar	*Lepisosteus osseus*	1	0.3	39
Drums	SCIAENIDAE			
Freshwater drum	*Aplodinotus grunniens*	1069	31.4	3-36
Paddlefishes	POLYODONTIDAE			
Paddlefish	*Polydon spathula*	2	0.34	32
Mooneyes	HIODONTIDAE			
Mooneye	*Hiodon tergisus*	3	0.28	14-19
	Total	5540	529.37	

Source: ORSANCO 1976.

in the Ohio River are now rarely found. Among other important fishes which seem to be declining in the Ohio River since 1900 are the yellow bullhead, blue catfish, the walleye and the silver lamprey (Trautman 1957).

On the other hand, the impounding of sections of the Ohio River seems to be creating conditions that are better suited to certain species, possibly due to less competition, or deeper, slower moving water, or a combination of both. Among the species which seem to be increasing in population are the channel catfish, black bullhead, the goldeye, the skipjack herring and the gizzard shad (ORSANCO 1962).

The nearest and most recent fish population study completed in the vicinity of the Ghent Station was a rotenone study of Markland Lock 5 miles up river on 30 October 1975 (ORSANCO 1976). Table 2.1-21 presents the findings. A total of 19 species were found totaling 5540 individuals for a total weight of 529.37 Kg. It is shown that the gizzard shad, carp, freshwater drum and channel catfish make up the majority of the population with gizzard shad making up the greatest percentage by number (70 percent) and the carp making up the greatest percentage by weight, (57 percent).

Similar findings were obtained from the survey at R.M. 570 (Public Service Indiana 1975). Table 2.1-22 presents results of four different methods of collection (seining, hoop-netting, gill netting and electro-fishing). Minnows and herrings were most numerous in the total sample due to the abundance of emerald shinners and gizzard shad. Low numbers of game fish were indicated by the sampling.

In a study completed by Wapora (1974) near the Tanner's Creek Plant (R.M. 496), 25 species of fish were collected by electro-fishing. The data indicate that the emerald shinner and gizzard shad were the most abundant in terms of numbers of fish, while the gizzard shad, carp, river carpsucker and largemouth bass contributed the greatest percent of total fish weight.

No rare or endangered species of fish were found in any of the before mentioned surveys. Table 2.1-23 lists the rare and endangered fish species of Kentucky.

Fish eggs and larvae surveys have been completed by Public Service Indiana (1975) at R.M. 570 and Wapora (1974) at R.M. 496. Table 2.1-24 presents reported spawning temperatures of 14 species of fish common to the Ohio River (Public Service Indiana 1975).

2.1.5 Aquatic Biota of the Ohio River

The Ohio River in earlier times consisted of a series of pools and riffles collecting natural run-off from the drainage basin. Now, however, it has been dammed and channelized to form a relatively narrow, deep trough without the pools and riffles. A series of high rise dams has within the past 20 years been built to replace the older roller dams. The construction of these high rise dams has in effect created a series of lakes or impoundments along the river, thereby modifying the original aquatic community to a more lake-like one (Wapora 1973).

In conjunction with the aquatic biota of the main stem of the Ohio River, a more lotic type community is found in small tributaries. An example would be Black Rock Creek into which the western portion of the Ghent Station drains. These small creeks are receiving increased interest as they provide the only shallow gravel bars and weeds suitable for spawning by several important fish species inhabiting the Ohio River, e.g. Sauger, Redhorse, Large and Small Mouth Bass and Golden Shiner (ORSANCO 1962, 1976).

In the following subsections, the aquatic biota will be discussed in terms of species composition of the major components. The components discussed include fish, phytoplankton, zooplankton, periphyton, benthic organisms and macrophytes.

Sources of data are from several recent studies performed on the Ohio River within 50 miles of the Ghent Station (R.M. 536). Public Service Indiana (1975) has completed a year long biological study (March 1974-February 1975) at R.M. 570 for its proposed nuclear station. In addition, the Ohio River Sanitation Commission (ORSANCO) has completed several studies (1962, 1976) including biological studies at Markland Dam which is located 5 miles upstream from the Ghent Station. Wapora, Inc. has had a continuing biological sampling program (1972, 1973, 1974) at the Tanner's Creek Plant (R.M. 496), 40 miles upstream from the Ghent Station.

2.1.5.1 Fish

A change in the fish population of the Ohio River has occurred since the 9 foot pool stage was established in 1929. The paddlefish and sturgeons that were once abundant

Geologic Unit - glacial outwasy, Pleistocene Age
Total Depth of Well - 127 ft
Date of Sample - 8/14/75
Dissolved Silica - 15 mg/l
Dissolved Iron - 10 mg/l
Dissolved Manganese - 10 mg/l
Dissolved Calcium - 99 mg/l
Dissolved Magnesium - 26 mg/l
Dissolved Sodium - 17 mg/l
Dissolved Potassium - 2.0 mg/l
Bicarbonate - 275 mg/l

Source: U.S.G.S. 1975

The main sources of drinking water for Carroll County are municipal or private wells. Carrollton Utilities furnished fluoridated, chlorinated and softened water to the city of Carrollton. Average use is about 500,000 gal per day. The Carroll County Water District supplies chlorinated water to the eastern part of the county including the communities of Worthville, Ghent and Sanders. Approximately 120,000 gal are supplied on an average day (Watkins and Associates 1974).

At many rural homes in areas where ground water is not sufficient for domestic or farm use, rainfall is collected and/or water is delivered to be stored in cisterns for later use. These areas are primarily located in the white region in Figure 2.1-14 where the average production of wells is only 100 gal per day.[1]

On-site wells for the Ghent Power Station will consist of two 200 gpm wells, one 400 gpm well and a fourth well with a flow rate of approximately 450 gpm. This availability of ground water will be more than adequate to supply the normal operating demand of 150 gpm per generating unit (Sargent and Lundy 1976).

All four wells servicing the Ghent Station are located in "Area I" or the area of ground water-rich alluvium near the Ohio River, as denoted in Figure 2.1-8. Maximum reported yield in this area is 500 gpm. Most properly drilled wells will produce several hundred gallons per minute.

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[1] Personal communication with Gene McMurry, local agricultural extension agent, Carroll County, Kentucky.

Table 2.1-20

Water Level At Noon, From Recorder Graph, Water Year 1974*

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
5	35.63	33.34	26.95	22.90	24.88	27.70	20.10	29.96	20.97	28.90	34.60	29.02
10	35.50	34.47	31.46	30.33	26.07	24.88	17.50	31.22	29.44	32.07	34.75	32.23
15	35.63	34.87	32.18	15.05	28.65	19.50	21.30	25.35	32.31	33.16	34.37	31.83
20	35.85	34.76	31.76	20.95	29.21	-	25.85	25.71	32.30	33.65	35.10	34.15
25	36.00	34.50	28.95	20.45	27.65	-	28.82	28.48	25.20	34.22	35.50	34.10
Eom	35.35	23.20	22.82	19.70	27.60	25.40	30.30	27.95	28.15	34.30	31.99	34.65

Water Year 1975

5	34.94	35.39	28.41	28.79	20.85	21.20	17.25	14.10	27.85	33.37	35.01	34.00
10	35.87	35.04	28.00	26.95	19.80	24.10	24.30	17.15	27.74	33.60	35.07	35.10
15	35.46	34.22	27.67	25.75	21.75	16.50	28.01	22.40	29.18	34.08	35.05	34.18
20	34.70	34.24	27.25	26.70	25.00	13.80	29.13	25.67	30.16	34.06	34.60	34.50
25	35.23	32.28	29.47	24.60	17.50	13.40	20.75	27.78	32.30	34.85	35.70	31.95
Eom	35.63	31.35	25.76	23.45	16.38	11.72	10.01	29.50	32.48	35.01	35.31	31.77

* Schenley Distillers, Inc. Carrollton. Drilled unused water-table well in sand and gravel of Quaternary age, diam 8 in (.20 m), depth 110 ft (34 m), screened 96-110 ft (29-34 m). Lsd about 455 ft (139 m) above MSL. MP top of casing, 3.40 ft (1.04 m) above lsd. Highest water level 9.00 ft (2.74 m) below lsd, March 10, 1955; lowest 38.31 ft (11.68 m) below lsd, December 19, 1960. Records available: 1951-75.

Source: U.S.G.S. 1975.

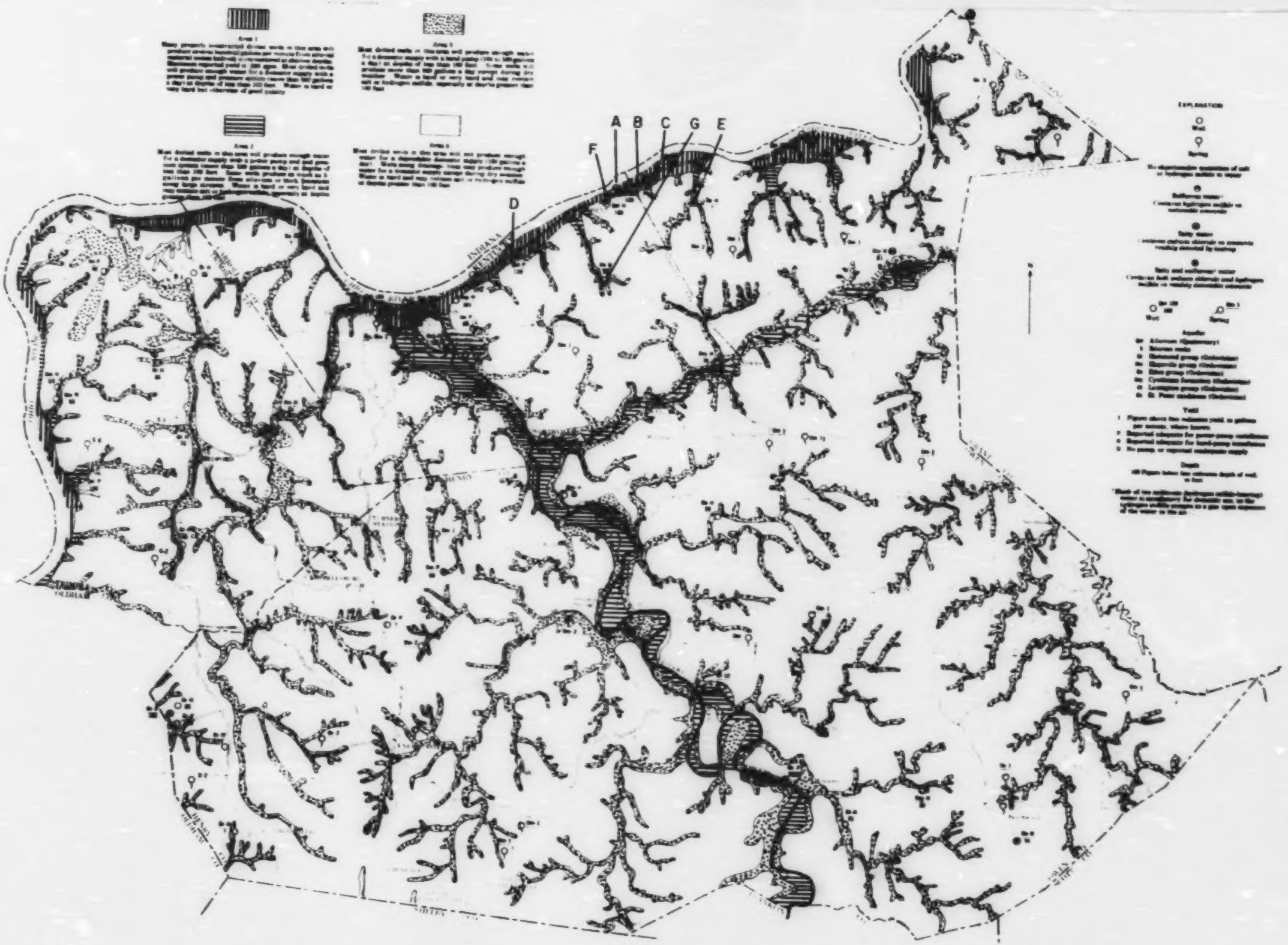


Figure 2.1-14. Availability of ground water in Carroll, Gallatin, Henry, Owen, and Trimble Counties, Kentucky.

Source: Hall and Palmquist 1960.

Table 2.1-19

Description of Wells Within 5 Miles of Ghent Station

Location* of Well	d**	Well Depth (feet)	Aquifer	Yield***	Quality
A	.8	120	Alluvium	100 gpm	Good
B	1.7	124	Alluvium	P	Good
C	2.8	100	Alluvium	P	Good
D	4.0	120	Alluvium	P	Good
E	3.7	?	Eden Group (Ordovician)	H	
F	.4	160	Alluvium	H	Salty & Sulfurous
G	3.2	50	Eden Group (Ordovician)	H	Good

* See Figure 2.1-14

** Distance from the Ghent Station (in miles)

*** P = Suitable for power-pump

H = Suitable for hand-pump

Source: Hall and Palmquist 1960.

Table 2.1-18

Number of Months During 1975 that Total and Fecal Coliform Criteria were met in the Ohio River

Location	Mile Point	States	Sampling Frequency	Public Water Supply			Recreation	
				Total	Fecal		Total	Fecal
					1000/100ml	200/100ml	Total	Fecal
Cincinnati	462.8	Oh-ky	5/week	6	12	6	0	3
Louisville	600.6	Ind-Ky	Daily	0	7	4	0	4

Criteria:

Public Water Supply

Total coliform:	Less than 5000/100 ml monthly average and overrun (Indiana, Kentucky);
Fecal coliform:	200/100 ml: less than 200/100 ml monthly geometric average and overrun (Illinois, Ohio, Pennsylvania);

Recreation--May through October

Total coliform:	Less than 100/100 ml monthly arithmetic average and overrun (Kentucky);
Fecal coliform:	Less than 200/100 ml monthly geometric average and overrun (Illinois, Indiana, Ohio, Pennsylvania, West Virginia).

Source: ORSANCO 1976

2.1.4.1.2.2 Total and Fecal Coliform

The Ohio River states have adopted various combinations of standards for acceptable total and fecal coliform concentrations in surface waters. Table 2.1-18 shows the number of months the requirements were met at Cincinnati and Louisville. There are 14 municipal sewage treatment plants that discharge into the Ohio River between Cincinnati and Louisville and are considered as the main source of coliform in the Ohio River (ORSANCO 1976).

Public Service Indiana (1975) sampled the Ohio River at R.M. 570 for fecal coliform concentrations. The fecal coliform results obtained from the Ohio River stations exceeded the Kentucky standards for all months except July, August and October.

2.1.4.2 Ground Water Hydrology

The most extensive sources of ground water in the region around the Ghent Station are the alluvial deposits along the Ohio River. From Lawrenceburg, Indiana to Carrollton, Kentucky, the alluvium averages about 1 1/2 miles in width and as much as 140 ft in thickness. The water in the unconsolidated deposits along the Ohio River is very hard, varying from about 250 to 340 mg/ℓ. The water also generally has objectionable concentrations of iron (U.S. Corps of Engineers 1966).

Adjacent to the Ohio River, ground water is readily available. Wells in this area yield up to 500 gpm. Along the Kentucky River and Eagle Creek, wells yield up to 5 gallons per minute (Watkins and Associates 1974). Table 2.1-19 describes the known wells within 5 miles of the Ghent Station on the south bank of the Ohio River. Figure 2.1-14 is a map of the North Kentucky region showing the availability of ground water and the location of the previously mentioned wells.

U.S.G.S. (1975) lists the water table at Schenley Distillers, Inc., Carrollton as varying from a high of 9.00 ft below the land surface datum (l.s.d., 455 ft M.S.L.), March 10, 1955 and a low of 38.31 ft below l.s.d. December 19, 1960. (Period of record: 1951-1975), (Table 2.1-20). Chemical data on the Schenley Distillers, Inc. well are as follows:

Table 2.1-17

Temperature (°C) of Water, Water Year October 1974 to September 1975 Mean Values

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.
1	21.0	17.0	8.5	6.0	5.5	6.5	8.5	16.5	24.0	28.0	29.5	29.5
2	20.5	16.5	8.0	6.5	5.5	6.0	9.0	16.5	24.0	28.5	29.5	29.0
3	20.0	16.5	7.0	6.5	5.5	5.5	9.0	16.0	24.0	28.5	29.5	29.5
4	20.0	16.5	7.0	6.5	5.5	5.5	9.0	15.5	24.0	29.0	29.5	29.0
5	19.5	16.5	6.5	6.5	5.5	5.5	9.0	18.0	24.0	29.0	29.5	29.5
6	19.5	16.5	6.5	6.5	5.5	6.0	9.0	17.0	24.0	29.0	29.5	30.0
7	19.0	16.0	6.5	6.5	5.5	6.0	9.5	16.5	24.0	29.0	29.0	29.0
8	19.0	15.5	6.5	6.5	4.5	6.0	9.5	16.0	24.0	28.5	29.0	28.5
9	19.0	15.0	6.0	6.0	4.5	6.5	9.5	16.5	23.5	27.0	29.0	28.5
10	19.0	15.0	5.5	6.0	4.5	6.5	10.0	16.5	23.5	27.0	29.0	28.0
11	19.0	15.0	5.5	7.0	4.5	7.0	10.0	16.5	23.5	28.0	29.0	28.0
12	19.0	15.0	5.5	7.0	4.5	6.5	10.0	18.0	23.5	28.0	29.0	28.0
13	19.0	14.5	5.5	6.5	4.0	6.0	10.0	18.0	23.5	28.0	29.0	27.0
14	19.0	14.0	5.5	6.5	4.0	6.0	10.0	18.5	23.5	28.0	28.5	25.5
15	19.0	13.0	5.5	6.0	4.0	6.0	10.5	19.0	23.5	28.0	28.5	25.0
16	19.0	12.0	6.0	6.0	4.0	6.0	10.5	19.0	23.5	28.0	29.0	24.5
17	18.5	12.0	6.0	6.0	4.5	6.0	10.5	19.0	24.0	28.0	29.0	24.5
18	18.5	12.0	5.5	6.0	5.5	6.0	11.0	19.5	24.0	27.0	29.0	24.0
19	18.0	12.0	5.5	6.0	5.5	6.0	11.5	20.0	24.5	27.0	29.0	24.0
20	17.0	12.0	5.5	6.0	6.0	6.5	12.0	20.5	24.5	27.0	29.5	24.0
21	16.5	12.0	5.5	5.5	6.0	7.0	12.0	20.5	25.0	28.0	29.5	24.0
22	16.5	11.5	5.5	5.5	6.0	8.5	13.0	21.0	25.5	28.5	29.5	23.5
23	16.0	11.0	5.5	5.5	6.5	9.5	13.0	21.5	25.5	28.5	29.5	23.0
24	16.0	11.0	5.5	5.5	7.0	10.0	13.5	22.0	26.0	28.5	29.5	22.0
25	16.0	11.0	5.5	6.0	7.0	10.0	14.0	22.0	26.5	28.5	29.5	21.0
26	16.0	10.5	6.0	6.0	6.5	10.0	14.5	22.0	26.5	29.0	29.5	20.0
27	16.0	10.0	6.0	6.0	6.5	9.5	15.0	23.0	27.0	29.0	30.0	19.5
28	16.0	9.5	6.0	6.5	6.5	9.0	16.0	23.5	27.0	29.0	30.0	19.5
29	16.0	9.5	6.0	6.5	-	9.0	15.5	23.5	27.0	29.5	29.5	19.5
30	16.5	9.0	6.0	6.0	-	9.0	16.0	24.0	27.0	29.5	29.5	19.0
31	16.5	-	6.0	5.5	-	8.5	-	24.0	-	29.5	29.5	-

Note: Mean daily temperature values for 3 November, 9-13 January, 28-30 January, 12-28 March, 30 March, 26-30 April, 6, 7, 10, 11 May based on once-daily readings furnished by Corps of Engineers

Source: U.S.G.S. 1975.

Table 2.1-15

Dissolved Oxygen 1975
Markland (R.M. 531.5)
(mg/ℓ)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Mo. Avg.	10.7	11.5	10.9	9.9	8.0	6.5	5.4	4.6	6.3	6.8	8.8	10.9
Min. Day	10.3	10.8	9.9	8.3	7.3	5.2	3.2	2.8	3.4	6.0	7.6	9.7
Min. Hour	10.2	10.6	9.9	7.6	6.9	4.7	3.1	2.6	3.2	5.9	7.3	9.6

Table 2.1-16

Ohio River Temperature Standards

Month	Temperature Deg. C	Month	Temperature Deg. C
January	10.0	July	31.7
February	10.0	August	31.7
March	15.6	September	30.6
April	21.1	October	25.6
May	26.7	November	21.1
June	30.6	December	13.9

Source: ORSANCO 1976.

Table 2.1-14
(cont'd)

Summary of USEPA STORET Water Quality Data
Ohio River at Markland Dam (River Mile 531.5)[1]

Parameter	Unit	Number of Samples	Mean Value	Maximum Value	Minimum Value
Phenols	mg/ℓ	1	0.003[2]	0.003[2]	0.003[2]
Phosphorus, dissolved P	mg/ℓ	15	0.059	0.132	0.01
Phosphorus, total P	mg/ℓ	16	0.128	0.21	0.084
Potassium, total	mg/ℓ	2	2.5	2.6	2.4
Selenium, total	mg/ℓ	3	0.003	0.003	0.003
Silica, total	mg/ℓ	1	5.62	5.62	5.62
Silver, dissolved	mg/ℓ	2	0.011[3]	0.020[3]	0.002[3]
Silver, total	mg/ℓ	6	0.00167[3]	0.0020[3]	0.001[3]
Sodium, total	mg/ℓ	2	13.5	13.8	13.2
Sulfate	mg/ℓ	23	86.57	130.0	59.0
Zinc, dissolved	mg/ℓ	5	0.044[3]	0.110[3]	0.020
Zinc, total	mg/ℓ	2	0.0325[3]	0.050[3]	0.015

[1] October 1971-June 1974

[2] Indicates values which violate standards

[3] The apparent disparity between dissolved and total concentrations for some constituents has not been resolved conclusively; however, it can be reasonably assumed that these analyses were performed using samples taken on dates which were not in common (as reflected by the number of samples taken).

Source: U.S. Environmental Protection Agency, "STOrage and RETrieval: System," computer printout, 7 February 1975.

Table 2.1-14

Summary of USEPA STORET Water Quality Data
Ohio River at Markland Dam (River Mile 531.5)[1]

Parameter	Unit	Number of Samples	Mean Value	Maximum Value	Minimum Valu
Water temperature	°F	22	65.46	82.4	32.0
Turbidity	JTU	20	22.25	56.0	8.0
Color	Units	20	9.31	20.0	5.0
pH	Std units	22	7.21	7.7	6.7
Hardness	mg/ℓ	-	-	-	-
Dissolved solids	mg/ℓ	22	207.65	334.37	2.19
Dissolved oxygen	mg/ℓ	22	6.94	11.8	3.0[2]
BOD 5-day	mg/ℓ	20	1.57	2.5	0.8
Total coliform	/100 mℓ	20	15,130.83[2]	71,000.0[2]	1,500.0
Fecal coliform	/100 mℓ	22	1,765.69[2]	37,000.0[2]	30.0
Alkalinity total	mg/ℓ	20	60.71	102.0	35.0
Non-filterable residue total	mg/ℓ	22	31.54	84.0[2]	3.0
Aluminum dissolved	mg/ℓ	1	0.200	0.200	0.200
Aluminum, total	mg/ℓ	1	0.500	0.500	0.500
Ammonia N	mg/ℓ	22	0.129	0.36	0.03
Arsenic, total	mg/ℓ	7	0.00625	0.010	0.002
Barium, total	mg/ℓ	-	-	-	-
Cadmium, dissolved	mg/ℓ	18	0.00383[3]	0.020[3]	0.001
Cadmium, total	mg/ℓ	14	0.00255[3]	0.008[3]	0.001
Calcium, total	mg/ℓ	2	32.05	32.1	32.0
Chloride	mg/ℓ	22	21.49	44.0	13.0
Chromium, dissolved	mg/ℓ	10	0.01944	0.030	0.010
Chromium, total	mg/ℓ	2	0.020	0.20	0.020
Copper, dissolved	mg/ℓ	11	0.02963[3]	0.050[3]	0.010
Copper, total	mg/ℓ	2	0.015[3]	0.015[3]	0.015
Flouride	mg/ℓ	20	0.201	0.33	0.13
Iron, dissolved	mg/ℓ	2	0.020	0.020	0.020
Iron, total	mg/ℓ	2	1.1250	1.7000	0.5500
Kjeldahl N, total	mg/ℓ	2	0.535	0.57	0.50
Lead, dissolved	mg/ℓ	19	0.01833[3]	0.1200[3]	0.005
Lead, total	mg/ℓ	17	0.01221[3]	0.050[2,3]	0.005
Manganese	mg/ℓ	3	0.14125	0.2100 [2]	0.065
Manganese, dissolved	mg/ℓ	18	0.05739[2]	0.3900 [2]	0.010
Magnesium, total	mg/ℓ	2	0.00925[2]	0.0094 [2]	0.0091
Mercury, total	mg/ℓ	7	0.00032[2]	0.00050[2]	0.0002
Nickel, dissolved	mg/ℓ	2	0.025	0.030	0.020
Nickel, total	mg/ℓ	2	0.030	0.030	0.030
Nitrite and Nitrate N-total	mg/ℓ	22	1.38	2.1	0.85

Table 2.1-13

Water Quality Data, Water Year October 1974 to September 1975

Date	Instantaneous Discharge (cfs)	Dissolved Silica (SIO2) (mg/ℓ)	Dissolved Calcium (CA) (mg/ℓ)	Dissolved Magnesium (mg) (mg/ℓ)	Dissolved Sodium (NA) (mg/ℓ)	Dissolved Potassium (K) (mg/ℓ)	Bicarbonate (HCO3) (mg/ℓ)	Alkalinity as CACO3 (mg/ℓ)	Dissolved Sulfate (SO4) (mg/ℓ)	Dissolved Chloride (CL) (mg/ℓ)	Dissolved Fluoride (F) (mg/ℓ)
10/30/74	32,100	4.4	51	15	33	4.0	89	73	120	40	0.4
11/27/74	122,000	5.0	51	2.0	23	3.2	81	66	85	30	0.3
12/20/74	197,000	6.8	35	10	13	2.3	75	62	22	57	0.2
1/24/75	215,000	6.5	29	8.0	13	2.0	64	53	52	17	0.2
2/27/75	451,000	5.9	42	9.2	12	2.4	109	89	55	15	0.3
3/28/75	470,000	6.1	26	7.8	8.8	2.0	56	46	52	11	0.1
4/15/75	69,500	6.3	35	11	13	2.0	71	58	71	15	0.1
5/13/75	122,000	5.7	28	8.3	9.8	1.8	61	50	56	11	0.3
6/10/75	129,000	5.6	33	9.6	15	2.2	63	52	66	17	0.4
7/22/75	38,100	-	49	13	22	2.9	103	84	78	28	0.4
7/30/75	13,200	-	38	11	23	3.6	85	70	73	27	0.3
9/23/75	70,900	5.9	44	12	25	7.0	71	58	100	31	0.4

Date	Total Nitrite Plus Nitrate (N) (mg/ℓ)	Total Kjeldahl Nitrogen (N) (mg/ℓ)	Total Nitrogen (N) (mg/ℓ)	Total Phosphorus (P) (mg/ℓ)	Dissolved Solids (Residue at 180°C) (mg/ℓ)	Hardness (CA, mg) (mg/ℓ)	Non-Carbonate Hardness (mg/ℓ)	Specific Conductance (μmhos)	pH (Units)	Temperature (°C)	Turbidity (JTU)
10/30/74	1.5	0.81	2.3	0.13	334	190	120	460	7.7	19.5	7
11/27/74	1.1	0.59	1.7	0.13	226	140	69	420	6.8	9.0	30
12/20/74	1.4	0.89	2.3	0.25	192	130	67	328	7.0	5.0	50
1/24/75	0.97	0.83	1.8	0.18	156	110	53	300	7.0	4.0	80
2/27/75	1.2	1.3	2.5	0.34	197	140	53	300	7.8	6.0	200
3/28/75	0.87	0.70	1.6	0.11	156	97	51	260	7.5	9.0	55
4/15/75	0.93	0.46	1.4	0.07	225	130	74	300	7.6	10.0	9
5/13/75	0.82	0.42	1.2	0.06	164	100	54	255	7.2	19.0	20
6/10/75	1.3	0.27	1.6	0.07	243	120	70	320	6.5	24.0	20
7/22/75	1.1	0.65	1.8	0.13	254	180	91	455	7.4	27.5	5
7/30/75	0.90	0.90	1.8	0.12	246	140	70	402	7.6	27.0	5
9/23/75	1.5	0.37	1.9	0.10	291	160	100	405	7.2	22.0	15

Date	Total Arsenic (AS) (μg/ℓ)	Dissolved Arsenic (AS) (μg/ℓ)	Total Cadmium (CD) (μg/ℓ)	Dissolved Cadmium (CD) (μg/ℓ)	Total Chromium (CR) (μg/ℓ)	Dissolved Chromium (CR) (μg/ℓ)	Total Cobalt (CO) (μg/ℓ)	Dissolved Cobalt (CO) (μg/ℓ)	Total Copper (CU) (μg/ℓ)	Dissolved Copper (CU) (μg/ℓ)	Total Iron (FE) (μg/ℓ)
10/30/74	1	1	1	1	10	1	0	1	13	6	530
1/24/75	3	1	1	1	<10	0	20	7	33	6	6,900
4/15/75	0	0	1	1	<10	2	6	0	5	3	990
7/22/75	1	0	0	0	<10	0	0	0	6	5	410

Date	Dissolved Iron (FE) (μg/ℓ)	Total Lead (PB) (μg/ℓ)	Dissolved Lead (PB) (μg/ℓ)	Total Manganese (MN) (μg/ℓ)	Dissolved Manganese (MN) (μg/ℓ)	Total Mercury (HG) (μg/ℓ)	Dissolved Mercury (HG) (μg/ℓ)	Total Selenium (SE) (μg/ℓ)	Dissolved Selenium (SE) (μg/ℓ)	Total Zinc (ZN) (μg/ℓ)	Dissolved Zinc (ZN) (μg/ℓ)
10/30/74	0	2	3	61	15	0.1	0.1	0	0	20	20
1/24/75	0	25	0	400	110	0	0	0	0	180	10
4/15/75	0	43	1	140	110	0	0	1	1	30	0
7/22/75	0	1	0	50	4	0	0	1	1	10	0

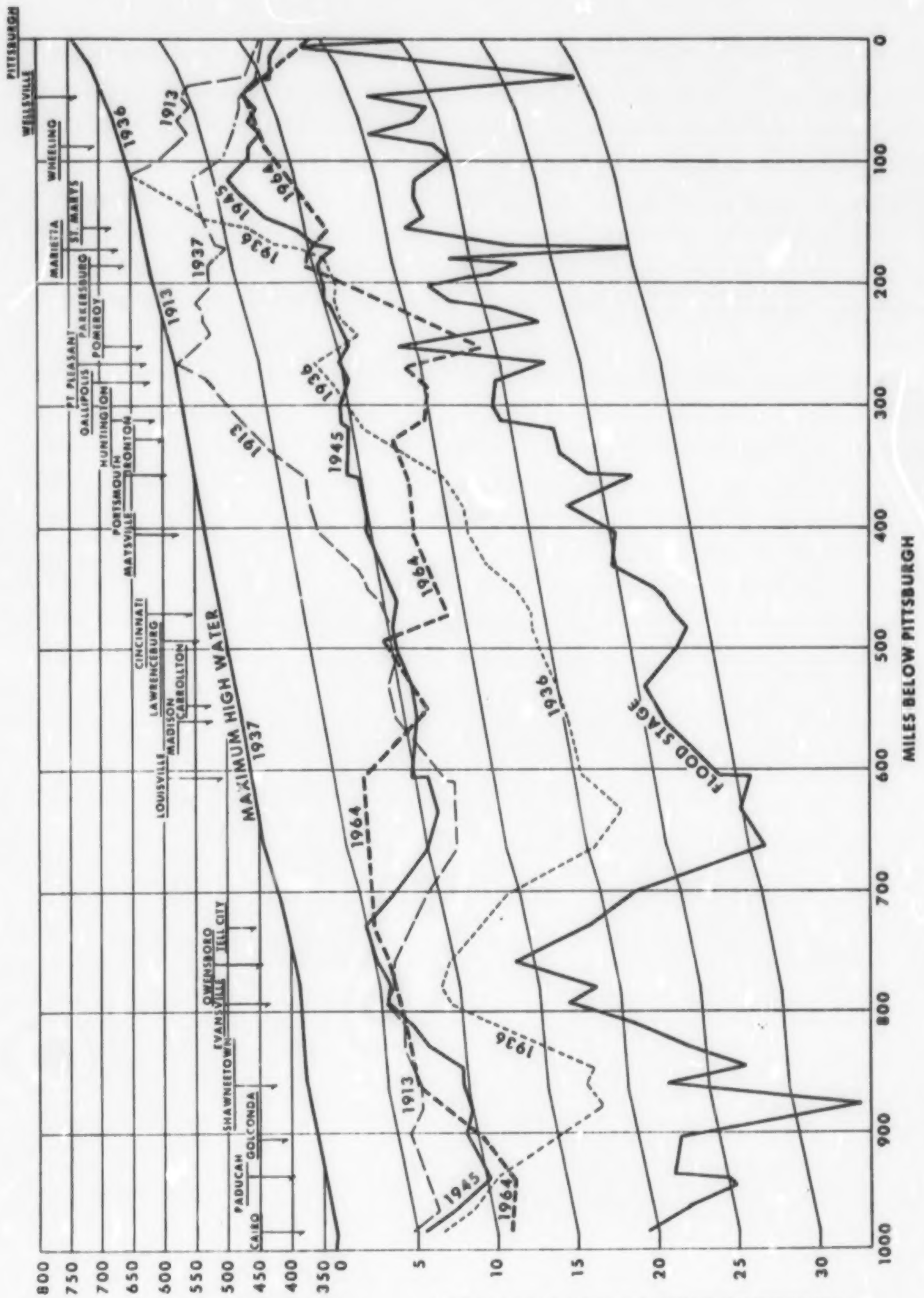
Source: U.S.G.S. 1975.

The Ohio River Valley Sanitation Commission (ORSANCO) monitors the water quality of the Ohio River to insure that established water quality standards for ammonia, barium, cadmium, chloride, chromium, fluoride, nickel, nitrate, selenium, silver, sulfate, total dissolved solids and zinc are met 100 percent of the time at all Ohio River monitoring stations (ORSANCO 1976). Tables 2.1-13 present monthly and quarterly data of specified chemical parameters for water year 1975 at Markland Dam. In addition, Table 2.1-14 presents a summary of USEPA STORET water quality data for the period October 1971 to June 1974.

Dissolved oxygen concentrations were less than the stream standard (daily average not less than 5 mg/ℓ, no value less than 4 mg/ℓ) one or more days during July or August at several monitoring stations between Cincinnati and Louisville. Table 2.1-15 gives a summary of the dissolved oxygen values at Markland Dam for 1975 (ORSANCO 1976).

Temperature standards for Illinois, Indiana, Kentucky, Ohio and West Virginia state that the maximum rise above natural temperature shall not exceed 5F and that the maximum temperature during any month shall not exceed values presented in Table 2.1-16.

During 1975 this standard was met 100 percent of the time. U.S.G.S. records daily temperatures at Markland Dam. The daily temperatures for water year 1975 are presented in Table 2.1-17.



Source: U.S. Corps of Engineers 1967.

Figure 2.1-13. Relative Flood Stage Profiles--Ohio River.

> *the main stem of the Ohio River with rainfall exceeding 16 inches at Paducah, Kentucky, and 13 inches at Louisville, Kentucky. The 39 reservoirs in operation and the 62 local protection projects prevented an estimated $290 million in damages, even though the reservoirs are located mostly in upper reaches of tributaries and the heaviest rainfall occurred below them. The reservoirs were therefore less effective in reducing flood stages than if the rainfall had been more widely distributed. (U.S. Corps of Engineers 1967)*

The relative flood stage profiles for the 5 floods of record are shown in Figure 2.1-13. The maximum predicted discharge rate at the Ghent Station for a 100-year flood is 820,000 cfs and a surface elevation of 476 ft (M.S.L.). This elevation is 11 ft under the elevation of the Ghent Power Station. The maximum predicted discharge for a 50-year flood is 770,000 cfs at an elevation of 474 ft (M.S.L.).

Low flows are of prime importance in the production of electricity by electric power plants. The requirement for cooling water necessitates that a minimum volume of water be available in order to operate the plant. Due to the increasing regulation of the Ohio River through storage reservoirs, a larger minimum flow can be maintained than in the past. At the present time, the value for the predicted 7 day, 10-year flow at the Ghent Station is uncertain; however, it is considered to fall within the range of 10,000 to 15,000 cfs (U.S.G.S. 1976). ORSANCO (1970) estimated the 7 day, 10-year low flow as 12,100 cfs for the river reach from Meldahl Dam (R.M. 436.2) to McAlpine Dam (R.M. 605.8).

2.1.4.1.2 Water Quality

2.1.4.1.2.1 Chemical and Physical

Water quality of the Ohio River in the Ghent Station vicinity is monitored by the U.S. Geologic Survey at Markland Dam, 5 miles upstream from the Ghent Station. The measurements are published annually in the Water Resources Data for Kentucky.

c. Flood of January-February 1937 (Flood of Record: F.O.R.)

The flood of January-February 1937 was the most disastrous ever in the Ohio River Basin. Excessive and almost continuous rainfall from January 6 to 25 caused maximum recorded stages in a 705 mile reach of the Ohio River below the mouth of Kanawha at Point Pleasant, West Virginia, to the mouth of the Ohio River at Cairo, Illinois. This flood interrupted virtually all communications and transportation between the north and south banks of the river for periods ranging from a week to a month. With the exception of the Cincinnati suspension bridge, every highway bridge approach from Marietta, Ohio, to the Mississippi River, a distance of 800 miles, was flooded and closed to traffic. At Cincinnati, the approaches were raised by an earth and sand bag ramp. Although generally not the most severe flood in Ohio River tributaries, this flood did produce record stages on the lower reaches of the Cumberland, Green and Kentucky Rivers; record stages on the Cumberland occurred to 160 miles upstream, above the present location of Cheatam Dam.

d. Flood of March 1945

The March 1945 flood was of major proportion along the entire main stem of the Ohio River, increasing in severity from Pittsburgh, Pennsylvania, to Louisville, Kentucky, where it was the second highest of record. Downstream of these cities, the stages were exceeded by several previous floods. It was not serious on most tributaries, many of which did not exceed flood stage in the upper reaches. Six reservoirs in operation in the Allegheny and Monongahela Basins reduced the 1945 flood stage at Pittsburgh by 1.8 feet. These and two reservoirs in the Beaver Basin resulted in a 2.3-foot reduction at Wheeling, West Virginia. The 14 reservoirs in the Muskingum Basin reduced flood stages 3.0 feet at Marietta, Ohio. With the exception of Dale Hollow on the Cumberland River and the T.V.A. reservoirs in the Tennessee River Basin, there were no additional major flood control reservoirs in 1945 in the Ohio River Basin downstream of the Muskingum River. Therefore, the reserovirs on the Ohio River flood crest could bring only a 1.0-foot reduction at Portsmouth, Ohio, 0.5-foot at Cincinnati, Ohio, and 0.2-foot at Louisville, Kentucky.

e. Flood of March 1964

The March 1964 flood was the fourth highest flood in the century at Cincinnati (stage 66.2 feet) and the maximum of record in the Licking and Little Miami Basins. The heavier rains were concentrated in the area along

Table 2.1-12

Ohio River Discharge at Markland Dam
Water Year 1975

LOCATION.--Lat 38°46'29", long 84°57'52", Gallatin County, at left end of Markland Dam, 0.4 mile (0.6 km) upstream from Stephens Creek, 3.4 miles (5.5 km) west of Warsaw, and at mile 531.5 (855.2 km).

DRAINAGE AREA.--83,170 sq mi (215,410 sq km), approximately.

PERIOD OF RECORD.--May 1970 to current year.

GAGE.--Gate opening and water-stage recorders on left bank. Turbine recorders in powerplant on right bank. Datum of headwater gage 0.5 mile (0.8 km) upstream is 443 ft (135.0 m) above mean sea level, Ohio River datum. Datum of tailwater gage 0.4 mile (0.6 km) downstream is 35 ft (10.7 m) lower.

AVERAGE DISCHARGE.--5 years, 130,500 cfs (3,696 cu m/s), 21.31 in/yr (541 mm/yr).

EXTREMES.--Current year: Maximum daily discharge, 460,000 cfs (13,000 cu m/s) Feb. 26; maximum headwater gage height, 13.67 ft (4.167 m) Mar. 18; maximum tailwater gage height, 47.41 ft (14.451 m) Mar. 18; minimum daily discharge, 12,100 cfs (343 cu m/s) July 30, 31.

Period of record: Maximum daily discharge, 465,000 cfs (13,200 cu m/s) Dec. 14, 1972; maximum headwater gage height, 17.20 ft (5.243 m) Jan. 15, 1974; maximum tailwater gage height, 50.52 ft (15.398 m) Dec. 14, 1972; minimum daily discharge, 10,500 cfs (297 cu m/s) July 9, 1971.

Flood of Jan. 26, 1937, reached a stage of 76.1 ft or 23.20 m (tailwater gage).

REMARKS.--Records fair. Daily discharge computed from head, gate openings, lockages, and turbine flows. Flow regulated by Ohio River system of locks, dams, and reservoirs upstream from station.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1974 TO SEPTEMBER 1975

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	31.800	38.800	144.000	223.000	291.000	410.000	430.000	370.000	107.000	51.500	31.800	85.300
2	31.400	30.300	189.000	235.000	324.000	369.000	410.000	322.000	112.000	39.700	20.600	142.000
3	29.000	34.400	210.000	264.000	329.000	283.000	360.000	289.000	126.000	45.000	13.000	130.000
4	34.700	35.600	199.000	280.000	333.000	228.000	330.000	263.000	145.000	50.600	17.100	103.000
5	35.300	44.500	179.000	265.000	334.000	200.000	222.000	240.000	143.000	58.300	25.500	70.000
6	31.700	58.000	156.000	226.000	334.000	182.000	201.000	248.000	121.000	66.900	26.700	54.700
7	30.100	60.200	135.000	198.000	334.000	162.000	185.000	250.000	139.000	48.300	32.400	54.700
8	23.800	61.900	164.000	188.000	315.000	151.000	160.000	226.000	155.000	49.800	33.800	59.000
9	23.800	65.200	180.000	165.000	315.000	163.000	134.000	180.000	153.000	32.900	29.600	41.400
10	22.300	50.400	224.000	164.000	285.000	183.000	119.000	161.000	134.000	43.900	23.500	34.200
11	27.900	48.900	250.000	225.000	239.000	205.000	113.000	141.000	111.000	42.000	23.500	44.400
12	29.100	56.600	247.000	224.000	200.000	249.000	93.100	135.000	96.700	39.800	28.300	42.000
13	24.400	67.300	220.000	209.000	212.000	325.000	87.700	124.000	95.000	29.000	27.900	68.800
14	22.600	73.000	188.000	190.000	251.000	390.000	84.000	102.000	107.000	30.600	33.400	83.800
15	28.400	75.600	175.000	182.000	264.000	425.000	71.500	98.800	112.000	29.000	51.100	73.200
16	33.200	82.100	182.000	172.000	232.000	396.000	68.900	104.000	114.000	30.900	64.500	55.000
17	41.300	73.800	185.000	154.000	190.000	405.000	75.100	120.000	93.700	33.800	99.000	34.300
18	60.700	68.300	191.000	141.000	165.000	400.000	66.900	129.000	110.000	23.600	103.000	50.400
19	57.200	68.500	197.000	156.000	164.000	389.000	72.500	145.000	101.000	30.000	82.200	50.100
20	50.700	64.600	194.000	187.000	177.000	394.000	77.900	148.000	85.600	33.800	39.200	72.500
21	36.600	79.100	169.000	222.000	189.000	374.000	86.600	135.000	81.900	39.000	29.100	81.900
22	39.600	101.000	148.000	240.000	190.000	377.000	86.800	125.000	63.300	37.400	21.200	91.200
23	27.800	121.000	129.000	241.000	268.000	383.000	86.500	91.000	68.300	36.700	24.600	76.800
24	33.700	127.000	123.000	199.000	415.000	424.000	158.000	95.800	45.800	19.300	23.000	118.000
25	40.700	119.000	124.000	160.000	450.000	435.000	270.000	114.000	57.600	35.700	22.700	202.000
26	37.900	123.000	141.000	170.000	460.000	430.000	332.000	112.000	38.000	33.800	27.400	262.000
27	38.100	124.000	171.000	217.000	455.000	420.000	390.000	105.000	66.700	27.600	25.100	250.000
28	32.100	137.000	201.000	258.000	440.000	410.000	410.000	97.600	68.400	31.800	21.800	162.000
29	32.000	140.000	228.000	263.000	------	400.000	420.000	102.000	66.400	24.900	23.000	113.000
30	33.200	131.000	234.000	250.000	------	410.000	410.000	83.300	71.1[illegible]	12.100	27.500	95.000
31	32.600	------	228.000	256.000	------	425.000	------	92.100	------	12.100	31.300	------
TOTAL	1.053.7M	2.360.1M	5.705.0M	6.524.0M	8.155.0M	10.397M	6.011.5M	4.948.6M	2.968.5M	1.119.8M	1.082.8M	2.800.7M
MEAN	33.990	78.670	184.000	210.500	291.300	335.400	200.400	159.600	99.620	36.120	34.930	93.360
MAX	60.700	140.000	250.000	280.000	460.000	435.000	430.000	370.000	155.000	66.900	103.000	262.000
MIN	22.300	30.300	123.000	141.000	164.000	151.000	66.900	83.300	38.000	12.100	13.000	34.200

CAL YR 1974 TOTAL 47.972.800 MEAN 131.400 MAX 458.000 MIN 18.800 CFSM 1.58 IN. 21.46
WTR YR 1975 TOTAL 53.146.700 MEAN 145.600 MAX 460.000 MIN 12.100 CFSM 1.75 IN. 23.77

M Expressed in thousands.

2.1.4.1.1 Flow Characteristics

Ohio River flow data from the gauging station at Markland Dam (R.M. 531.5) are available from 1970 to the present (USGS 1975). Means and extremes for this period along with daily flow data for the water year 1975 (October 1974 to September 1975) are presented in Table 2.1-12. Average flow for the period of record at Markland Dam is 130,500 cfs. Maximum flow was recorded as 465,000 on 14 December 1972 and reached a pool elevation 458.52 ft M.S.L. (Ghent Station elevation 487 ft M.S.L.). Minimum flow for the period of record at Markland Dam was 10,500 cfs on 9 July 1971.

There have been 5 major floods that occurred on the Ohio River before gauging records began at Markland Dam. Descriptions are presented below:

> *a. Flood of March 1913*
>
> *The March 1913 flood originated in the northern part of the Ohio River, particularly in the watersheds of the Beaver, Muskingum, Scioto, Great Miami and Wabash Rivers, where all previous highwater records were exceeded. The southern tributaries contributed only moderate flows. Through 1964, the 1913 flood had not been exceeded on the main stem in the reach from New Martinsville, West Virginia, to upstream of the mouth of the Kanawha River at Point Pleasant, West Virginia. The peak discharge at Pomeroy, Ohio was 633,000 cfs on March 30.*
>
> *b. Flood of March 1936*
>
> *The March 1936 flood was caused by storms centered largely over the Monongahela and Allegheny River Basins. The rainfall was particularly heavy in the mountainous eastern portion of the Basin. Run-off from snowmelt further aggravated the flood. In some areas for some periods, the run-off from snowmelt exceeded that from rainfall. Coincidental heavy rains caused flood crests on the Monongahela and Allegheny Rivers to arrive almost simultaneously at Pittsburgh, Pennsylvania, resulting in a record high. Record stages occurred on the main stem to Dam 14, 20 miles below Wheeling, West Virginia, and 115 miles below Pittsburgh, Pennsylvania, and above Pittsburgh to 45 miles up the Allegheny River to Kittanning, Pennsylvania, and 23 miles up the Monongahela River to Elizabeth, Pennsylvania.*

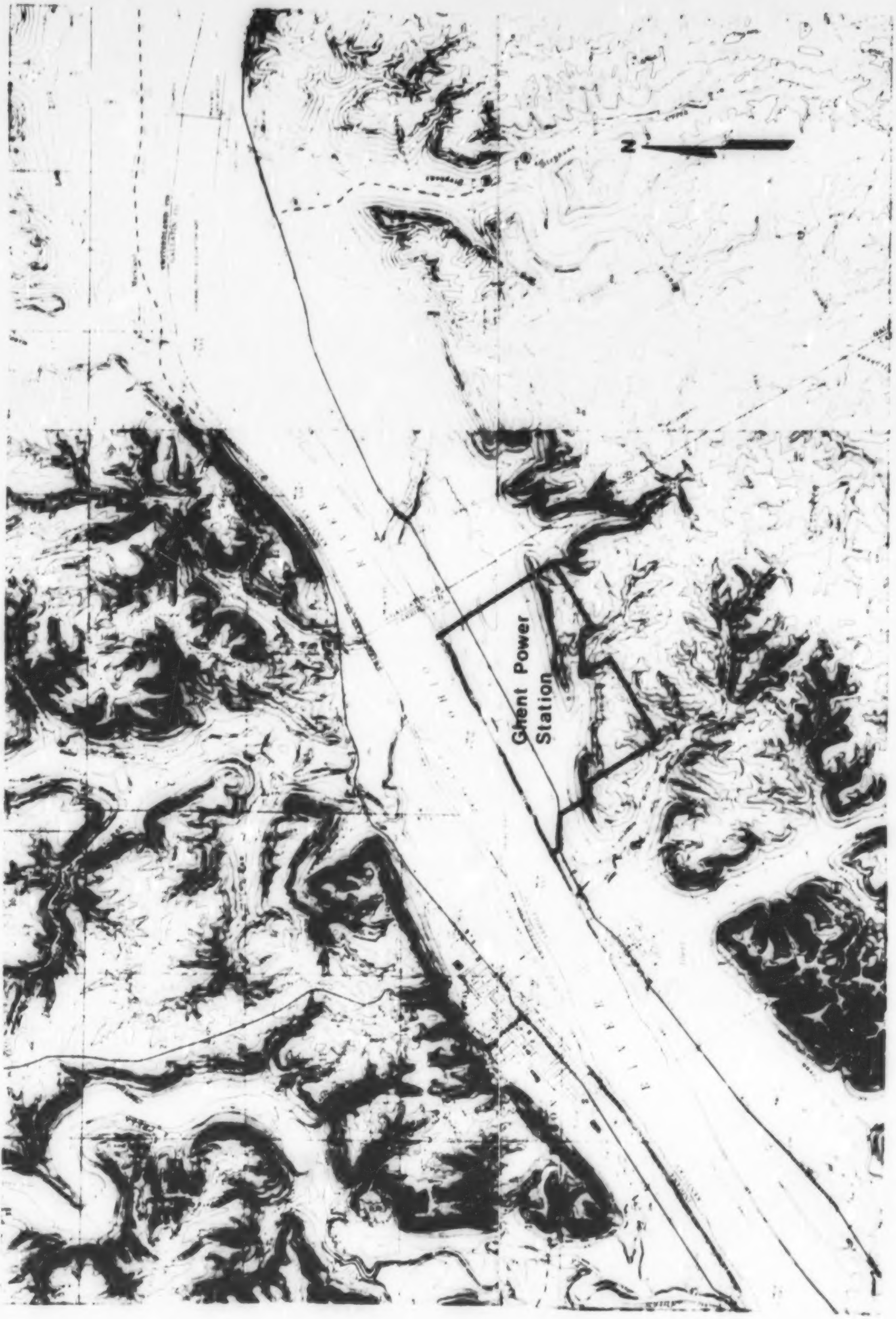


Figure 2.1-12. Ghent Power Station Location.

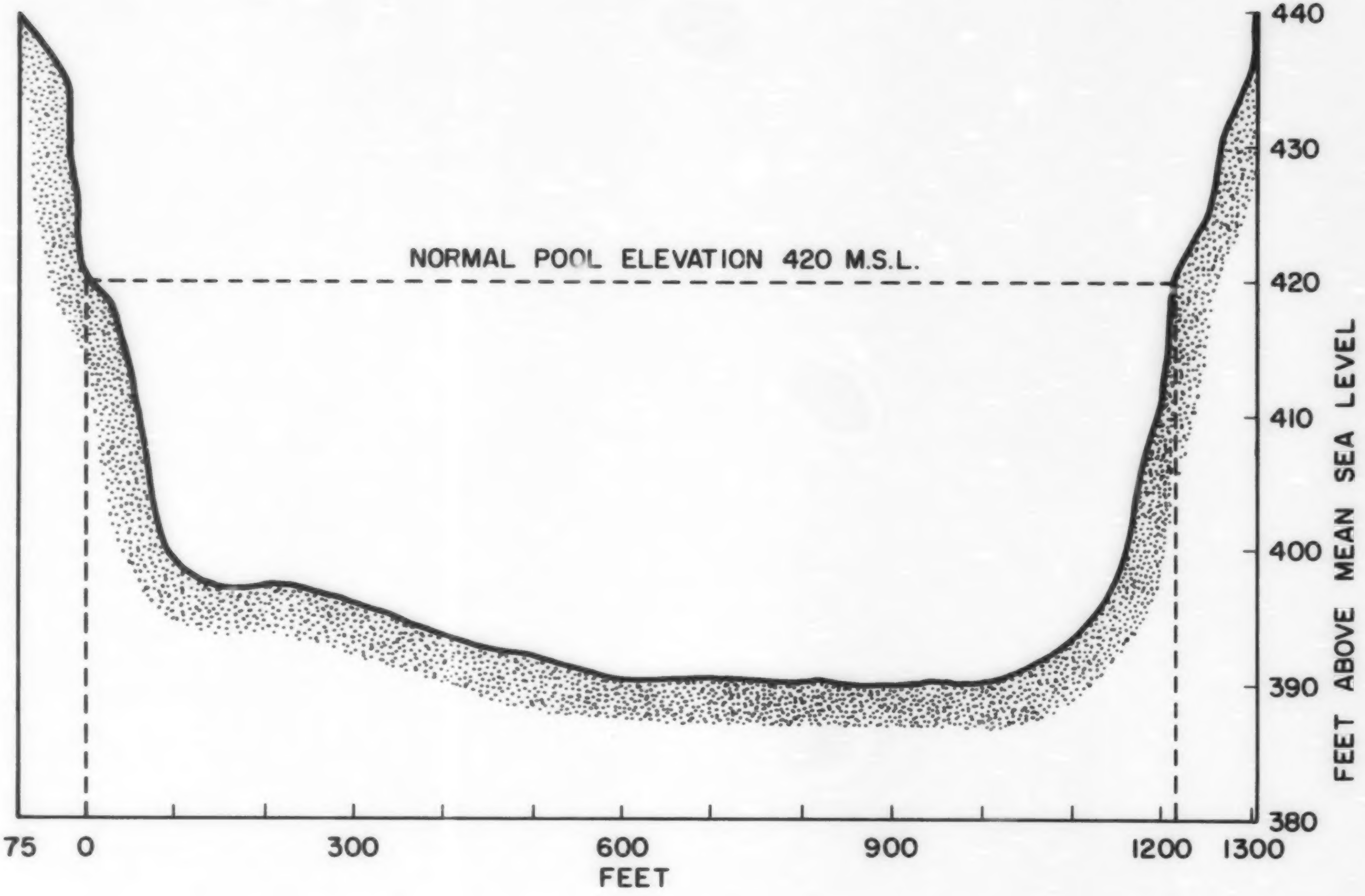
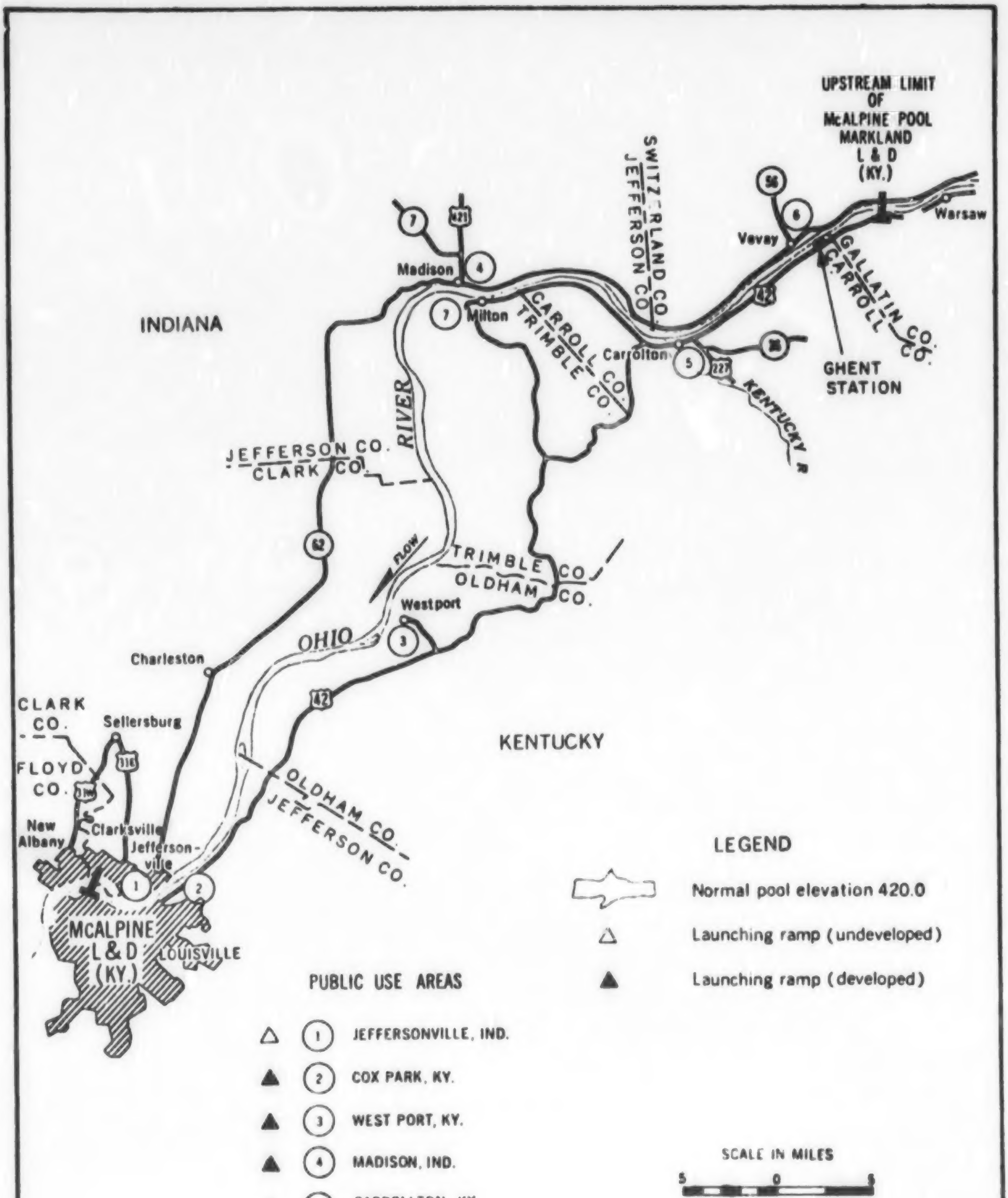


Figure 2.1-11. Ohio River Cross-section at Ghent Power Station.



Source: U.S. Corps of Engineers, 1975.

Figure 2.1-10. McAlpine Pool Reach--Ohio River.

Table 2.1-11.

Tributaries of Ohio River
Vicinity of Ghent Station

Tributary	River Mile	Bank
Stephens Creek	532.0	S
Log Creek	533.0	N
Agniels	534.7	S
Plum Creek	535.6	N
Ghent Station	536.5	S
Black Rock Creek	537.0	S
Indian	540.0	N
McCools Creek	540.7	S

The location of the power station is on the upper reaches of the McAlpine Pool, which is formed as a result of McAlpine Dam located in Louisville at river mile 607.3. The flow of the Ohio River at the Ghent Power Station is affected by discharges of Markland Dam 5.5 miles upstream at river mile 531.5 and storage in McAlpine Pool (Figure 2.1-10).

2.1.4.1 Surface Water Hydrology

The Ohio River is the dominant feature when discussing the surface water hydrology of the region in which the Ghent Power Station is located. The width of the Ohio River, at the point where the station is located, is 1215 ft with a maximum depth of 30 ft at normal pool elevation (420 ft M.S.L.)(Figure 2.1-11). The Ohio River at this point flows in a southwesterly direction, includes a drainage area of 83,170 square miles (at Markland Dam) and includes 13 principal tributaries and a vast number of smaller creeks emptying into the Ohio River main stem.

Table 2.1-11 lists the tributaries 5 miles upstream and downstream from the station. The western portion of the Ghent Station is drained principally by a small creek which discharges into Black Rock Creek shortly before it joins the Ohio River (Figure 2.1-12). The drainage area of the entire Black Rock Creek system is 1647.4 acres of which 361.8 acres or 21.9 percent is within the station boundaries. The composition of the drainage basin is of almost equal areas of mixed forest and farmland. Although no water chemistry was performed, it can be assumed that the water quality of the creek is fairly high as opposed to drainage basins with less vegative cover and the possibility of more erosion. The eastern portion of the Ghent Station contains the existing ash pond which collects the majority of the rainfall and run-off from this area and discharges it into the Ohio River after allowing for settling of suspended solids.

the most abundant game animal and bobwhite as the most abundant game bird. During the period 1961-1970, hunters in Carroll County killed an estimated average total of 95 ducks per year of which mallards (*Anas platyrhynchos*) and black ducks (*A. rubripes*) composed the majority of those harvested (Carney et al. 1975). The mourning dove sustains a sizeable amount of hunting effort in Kentucky, but most other migratory non-waterfowl birds do not (U.S. Fish and Wildlife Service undated: 9; Artman 1975). Of the rare and/or endangered vertebrate species, there is only one, the Indiana bat (*Myotis sodalis*), which is likely to occur in the Ghent area. This species is listed as "threatened" by the U.S. Fish and Wildlife Service (1973: 209) and "endangered" by the U.S. Fish and Wildlife Service (1974). The Indiana bat is distributed in the midwestern and eastern United States from the western edge of the Ozark region in Oklahoma to central Vermont and south to northern Florida. Its populations are normally associated with major cavernous limestone areas, of which the Bluegrass Region has many (Bailey 1933; Funkhouser 1925). A fairly extensive literature is available on this bat and is summarized by the U.S. Fish and Wildlife Service (1976). The American and Arctic peregrine falcons (*Falco peregrinus anatum and F. p. tundrius*) and the Southern bald eagle (*Haliaeetus leucocephalus leucocephalus*) possibly visit the area during migration, but habitat of suitable quality for extensive nesting and feeding during the migration probably does exist at Ghent.

2.1.4 Hydrology

The Ohio River flows from its head at the confluence of the Monongahela and Allegheny Rivers in Pittsburgh for a distance of 981 miles to its mouth at the Mississippi River in Cairo, Illinois. The Ohio River drainage basin is large, covering most of the states of Ohio, Indiana, Kentucky, Tennessee and West Virginia, and parts of Pennsylvania, Alabama, Illinois, New York and Virginia. Because the drainage area is so extensive, the river is subject to considerable increases in flow and high volumes of run-off during times of heavy rainfall often resulting in floods (Wapora 1973).

The Ghent Power Station is located on the Kentucky side on the south bank of the Ohio River, 536 river miles downstream from Pittsburgh. The existing Units 1 and 2 are presently located on a floodplain approximately 330 ft from the Ohio River shoreline and 67 ft above normal pool elevation of the Ohio River (420 ft M.S.L.).

2.1.3.2 Fauna

The wildlife of the area surrounding the Ghent Power Plant is influenced in its diversity and abundance by the location of the power plant on the banks of the Ohio River at the periphery of the Outer Bluegrass Region. The topographic relief created by the sudden drop in terrain from the uplands to the river floodplain, from there across the floodplain and into the river channel proper, promote great local diversity in habitats and, therefore, among vertebrate animals. The river itself is a migratory pathway and feeding and resting area for waterfowl and shorebirds (U.S. Fish and Wildlife Service undated: 9). Streamside animals such as raccoons and mink (*Mustela vison*) are apparently abundant along its edge. Riverside forests harbor a variety of resident and migratory birds. The river floodplain, about 80 ft above normal water level, provides open pastureland and farmland areas, extensive brushy edges, and woodlots as habitat for animals such as cottontailed rabbits, bobwhite and opossums (*Didelphis virginiana*). Woody and brushy hillsides rising to the uplands from the floodplains are a different kind of habitat, and harbor gray squirrels and fox squirrels (*Sciurus niger*), ruffed grouse (*Bonasa umbellus*), white-tailed deer, and a variety of songbirds. The U.S. Fish and Wildlife Service (undated: 64) has estimated that the Ohio River Valley (including surrounding uplands) is about 43 percent farm game (rabbits, bobwhite) habitat, 33 percent forest game (squirrels, deer) habitat, and 1.8 percent waterfowl habitat.

During the on site visit, one reptile, one amphibian, 24 birds and 10 mammal species were encountered by sight, sound or observation of sign. About 32 amphibians, 30 reptiles, 255 birds and 40 mammals are described in the literature as having ranges encompassing the area (Barbour 1956b; Barbour et al. 1966)(Appendices A-2 to A-4).

Animals inhabitating the Ghent site which are hunted (Kentucky Department of Fish and Wildlife Resources 1976) for sport include cottontailed rabbits, gray squirrels, fox squirrels, woodchucks (*Marmota monax*), white-tailed deer, bobwhite, ruffed grouse, mourning doves, woodcock (*Philohela minor*), opossums, raccoons, red foxes (*Vulpes vulpes*), gray foxes (*Urocyon cinereoargenteus*) and several waterfowl species. The U.S. Fish and Wildlife Service (undated: 7) describes the cottontailed rabbit as

Table 2.1-10

Endangered (E) and threatened (T) plants of Kentucky (Smithsonian Institution 1975).

FAMILY	SPECIES	STATUS
Asteraceae	*Eupatorium resinosum var. kentuckiense*	E
Asteraceae	*Helianthus eggertii*	E
Asteraceae	*Solidago albopilosa*	E
Asteraceae*	*Solidago shortii*	E
Brassicaceae	*Arabis perstellata var. perstellata*	E
Brassicaceae	*Leavenworthia exigua var. laciniata*	E
Lamiaceae	*Conradina verticillata*	E
Apiaceae	*Oxypolis canbyi*	T
Asteraceae	*Prenanthes roanensis*	T
Brassicaceae	*Leavenworthia torulosa*	T
Brassicaceae	*Lesquerella globosa*	T
Caryophyllaceae	*Arenaria fontinalis*	T
Caryophyllaceae*	*Stellaria fontinalis*	T
Cyperaceae	*Carex purpurifera*	T
Ericaceae	*Rhododendron bakeri*	T
Fabaceae	*Apios priceana*	T
Hypericaceae*	*Hypericum sphaerocarpum var. turgidum*	T
Orchidaceae	*Cypripedium candidum*	T
Orchidaceae	*Platanthera flava*	T
Orchidaceae	*Platanthera peramoena*	T
Poaceae	*Muhlenbergia torreyana*	T
Polemoniaceae	*Phlox bifida var. stellaria*	T
Polemoniaceae*	*Polemonium reptans var. villosum*	T
Polypodiaceae	*Asplenium kentuckiense*	T
Primulaceae	*Dodecatheon frenchii*	T
Saxifragaceae	*Saxifraga caroliniana*	T
Saxifragaceae	*Sullivantia ohionis*	T
Scrophulariaceae	*Aureolaria patula*	T
Violaceae	*Viola egglestonii*	T

* Possibly occur in the regions surrounding both the Ghent and Green River Power Stations.

Table 2.1-9 (cont'd)

Occurrence and general abundance of woody plant species encountered on upland slopes and ridges at the Ghent Power Plant.

UNDERSTORY VEGETATION

Species	Occurrence and Abundance
Greenbrier *(Smilax sp.)*	Common; edges, openings
Eastern Hophornbeam *(Ostrya virginiana)*	Infrequent; woodlands
Blackberry *(Rubus sp.)*	Abundant locally; edges, openings
Prairie Rose *(Rosa setigera)*	Abundant; edges, openings
Honey Locust *(Gleditsia triacanthos)*	Common; edges, fencerows
Shining Sumac *(Rhus copallina)*	Common invader; edges
Rough-leaf Dogwood *(Cornus drummondii)*	Local; edges
Snowberry *(Symphoricarpos orbiculatus)*	Abundant; edges, openings

Table 2.1-9

Occurrence and general abundance of woody plant species encountered on upland slopes and ridges at the Ghent Power Plant.

OVERSTORY VEGETATION

Species	Occurrence and Abundance
Eastern Red Cedar *(Juniperus virginiana)*	Abundant invader of open areas
Bitternut Hickory *(Carya cordiformis)*	Common, hillside woodlands
Shagbark Hickory *(C. ovata)*	Scattered; hillsides
Black Walnut *(Juglans nigra)*	Common; woodlands
American Beech *(Fagus grandifolia)*	Infrequent; woodlands
Chinquapin Oak *(Quercus muhlenbergii)*	Locally common; rocky slopes
Pin Oak *(Q. palustris)*	Common; woodlands
Black Oak *(Q. velutina)*	Common locally
Hackberry *(Celtis occidentalis)*	Abundant; various sites
American Elm *(Ulmus americana)*	Common; lower slopes
Slippery Elm *(U. rubra)*	Common; woodlands
Magnolia *(Magnolia sp.)*	Infrequent; woodlands
Yellow Poplar *(Liriodendron tulipifera)*	Locally abundant; woodlands
American Sycamore *(Platanus occidentalis)*	Local; near ravines
Wild Plum *(Prunus sp.)*	Common; edges
Black Cherry *(Prunus serotina)*	Common; woodlands
Kentucky Coffeetree *(Gymnocladus dioicus)*	Locally common; second growth
Black Locust *(Robinia pseudoacacia)*	Abundant; second growth and edges
Sugar Maple *(Acer saccharum)*	Abundant; hillside woodlands
Box Elder *(A. negundo)*	Abundant; second growth and edges
Buckeye *(Aesculus sp.)*	Locally common; woodland edges
Basswood *(Tilia americana)*	Infrequent; woodlands
American Ash *(Fraxinus americana)*	Abundant; second growth and edges

Table 2.1-8

Occurrence and general abundance of woody plant species encountered on the Ohio River slope and on the river floodplain at the Ghent Power Plant.

OVERSTORY

Lower Slope (Below Normal High Water Level (See Fig. 2.1-9))	
Cottonwood *(Populus deltoides)*	Dominant; large trees
Black Willow *(Salix nigra)*	Common; streamside
American Elm *(Ulmus americana)*	Common
American Sycamore *(Platanus occidentalis)*	Dominant; large trees
Silver Maple *(Acer saccharinum)*	Dominant; large trees
Red Maple *(A. rubrum)*	Common
Upper Slope (Between Normal High Water Level and Floodplain)	
Hackberry *(Celtis occidentalis)*	Dominant
American Elm *(Ulmus americana)*	Dominant
American Sycamore *(Platanus occidentalis)*	Common
Black Cherry *(Prunus serotina)*	Infrequent to common
Black Locust *(Robinia pseudoacacia)*	Common
Sugar Maple *(Acer saccharum)*	Dominant
Basswood *(Tilia americana)*	Infrequent
White Ash *(Fraxinus americana)*	Common
Floodplain	
Black Willow *(Salix nigra)*	Common; streamsides
American Elm *(Ulmus americana)*	Common; edges, streamsides
American Sycamore *(Platanus occidentalis)*	Along drainageways
Black Locust *(Robinia pseudoacacia)*	Abundant; edges, invader
Honey Locust *(Gleditsia triacanthos)*	Common; edges, openings

UNDERSTORY (Floodplain)

Blackberry *(Rubus sp.)*	Common; edges
Prairie Rose *(Rosa setigera)*	Common; edges
Honeysuckle *(Lonicera japonica)*	Abundant; edges
Snowberry *(Symphoricarpos orbiculatus)*	Abundant; edges
Elderberry *(Sambucus canadensis)*	Common; edges

(*Acer saccharum*), American elm and black locust (*Robinia pseudoacacia*). The floodplain proper is mostly in farmland and pastureland, with black locust, American sycamore and American elm along edges and small drainageways. Adjacent to and above the floodplain on the more gentle slopes exist pasturelands, locally invaded by black locust, eastern red cedar (*Juniperus virginianus*), and honey locust (*Gleditsia triacanthos*). Blackberry (*Rubus* sp.), prairie rose (*Rosa setigera*), and snowberry (*Symphoricarpos orbiculatus*) grow along fencerows and edges. Upper slopes above the floodplain are either cut-over (in most areas) or mature (locally in very steep areas) forests. Dominants here are such hardwoods as sugar maple, bitternut hickory (*Carya cordiformis*), black walnut (*Juglans nigra*), and yellow poplar (*Liriodendron tulipifera*) in mature stands and black locust, box elder (*Acer negundo*), and hackberry in second-growth forests.

Table 2.1-8 and 2.1-9 further describe the occurrence and general abundance of woody species found on the lowlands and uplands, respectively, at the Ghent site. Species within these tables are segregated by topographic community type and by stature (overstory and understory). Woody species found at the Ghent Station are similar in occurrence and abundance to those of nearby woodlands as reported by Gentry (1963) and Keith (1967). A further species list of vascular plants known to occur in the Ghent area is presented in Appendix A-1.

2.1.3.1.3 Rare and Endangered Plant Species

Since the Mixed Mesophytic Forest was the center of origin for many widely-established species and still contains good habitat for most of these, the number of endangered or threatened species is few. Table 2.1-10 lists these species in Kentucky officially considered endangered or threatened (Smithsonian Institution 1975). Distributions within Kentucky of the listed species were difficult to ascertain from the literature. However, based upon a general evaluation of the habitats of those listed, it is probable that only the ones so indicated (*Stellaria fontinalis, Hypericum sphaerocarpum var. turidum and Polemonium reptans var. villosum*) could occur within the general region of the station. In addition to those listed, Wharton and Barbour (1971) mention other species that seem, based upon their general distribution and habitats, likely to occur near the two areas. These species are Goldseal (*Hydrastis canadensis*), Canada Mayflower (*Maranthemum canadense*), Gensing (*Panax quinquefolium*), and all other orchids occurring there.

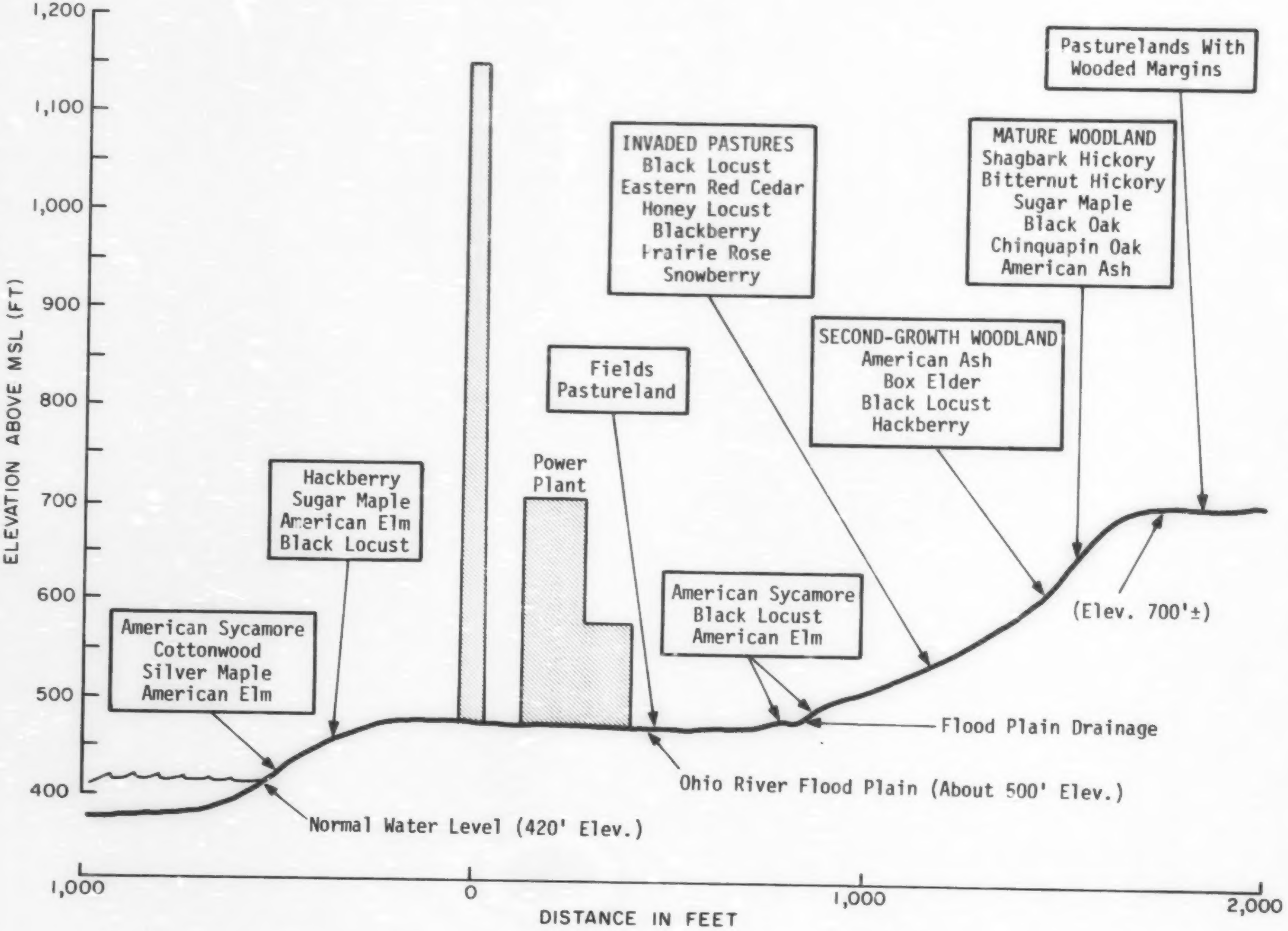


Figure 2.1-9. Topographical cross-section (diagrammatic) depicting vegetation communities surrounding the Ghent Power Station, Carroll County, Kentucky.

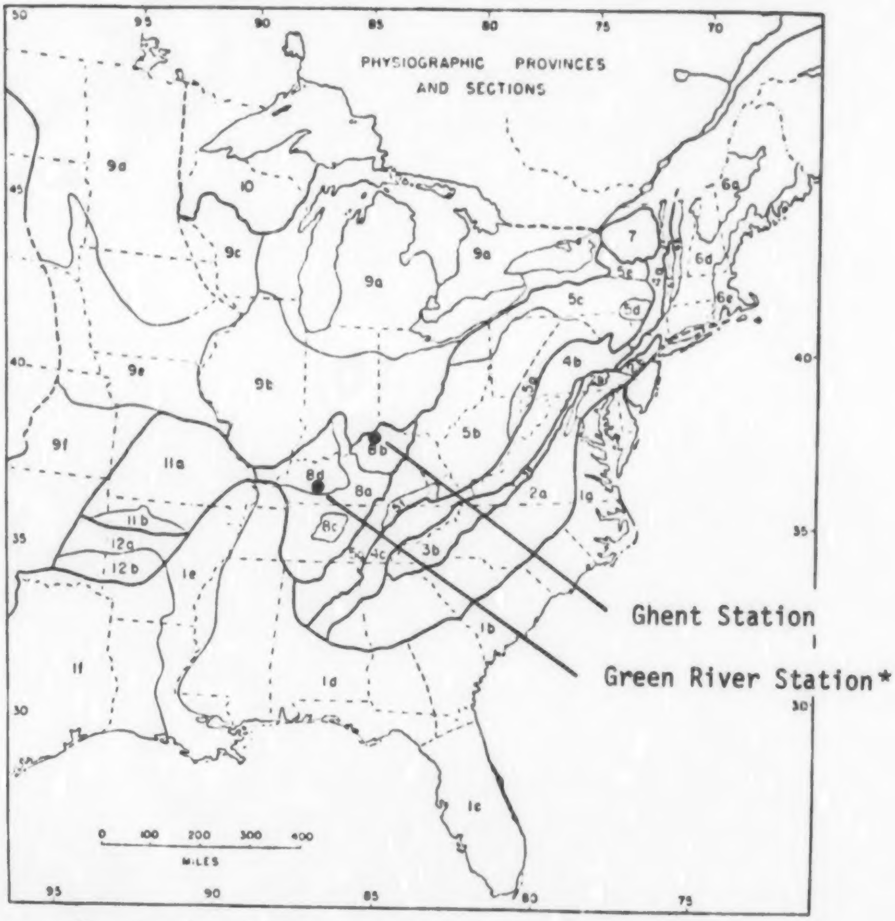
Unlike the Mixed Mesophytic Forest Region on the east, this region is not characterized by a single climax type but is composed of a mosaic of vegetation types. This complex mosaic is the result of past and present influences (e.g., substrate, topography) operative within recent enough time that their effects upon vegetation have not yet been eliminated. These transition forests are less luxuriant than the Mixed Mesophytic Forest Region. There is greater tendency toward dominance by a few species and community composition is more influenced by habitat factors. Forest composition shifts in its western portions toward forests dominated by oaks. This region has a variety of upland forest types and extensive alluvial swamps. Geology appears to be the prime factor affecting the flora and plant distribution of the state. Geologic structure determines the parent material, and this influences the physical and chemical soil structure. Topography also plays an important role in plant distribution; certain species do have broad ranges but generally still will occur on a limited number of sites. Past glaciation, as pointed out by Braun (1951) also has had an important influence on plant distribution, with this region serving as a refuge for plants during the glaciation period.

The total vascular flora of Kentucky includes well over 2,000 species of ferns and seed plants (Wharton and Barbour 1971). Woody plants comprise over 280 species (Wharton and Barbour 1973); grasses, sedges and rushes comprise over 350 species.

No other associations in the Eastern Deciduous Forest Formations are as diverse. This diversity is promoted by the presence in the flora of Appalachian species, southern species, northern species, swamp species and many species characteristic of more easterly regions in the United States.

2.1.3.1.2 On-Site Vegetation

Land use and the resultant vegetation cover at the Ghent site is greatly influenced by topography (Figure 2.1-9). Woodlands between normal water level and normal high water level bordering the Ohio River are dominated by American sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*) and American elm (*Ulmus americana*). Above this normal high water mark but below the floodplain, dominance is assumed by hackberry (*Celtis occidentalis*), sugar maple



Map of Physiographic Provinces and Sections. (After Fenneman, 1938.)

* Green River is an alternative site for the proposed units (see Section 4.2.2).

Figure 2.1-8. Location of Ghent and Green River power stations within the Interior Low Plateau Province of Fenneman (1938).

LEGEND

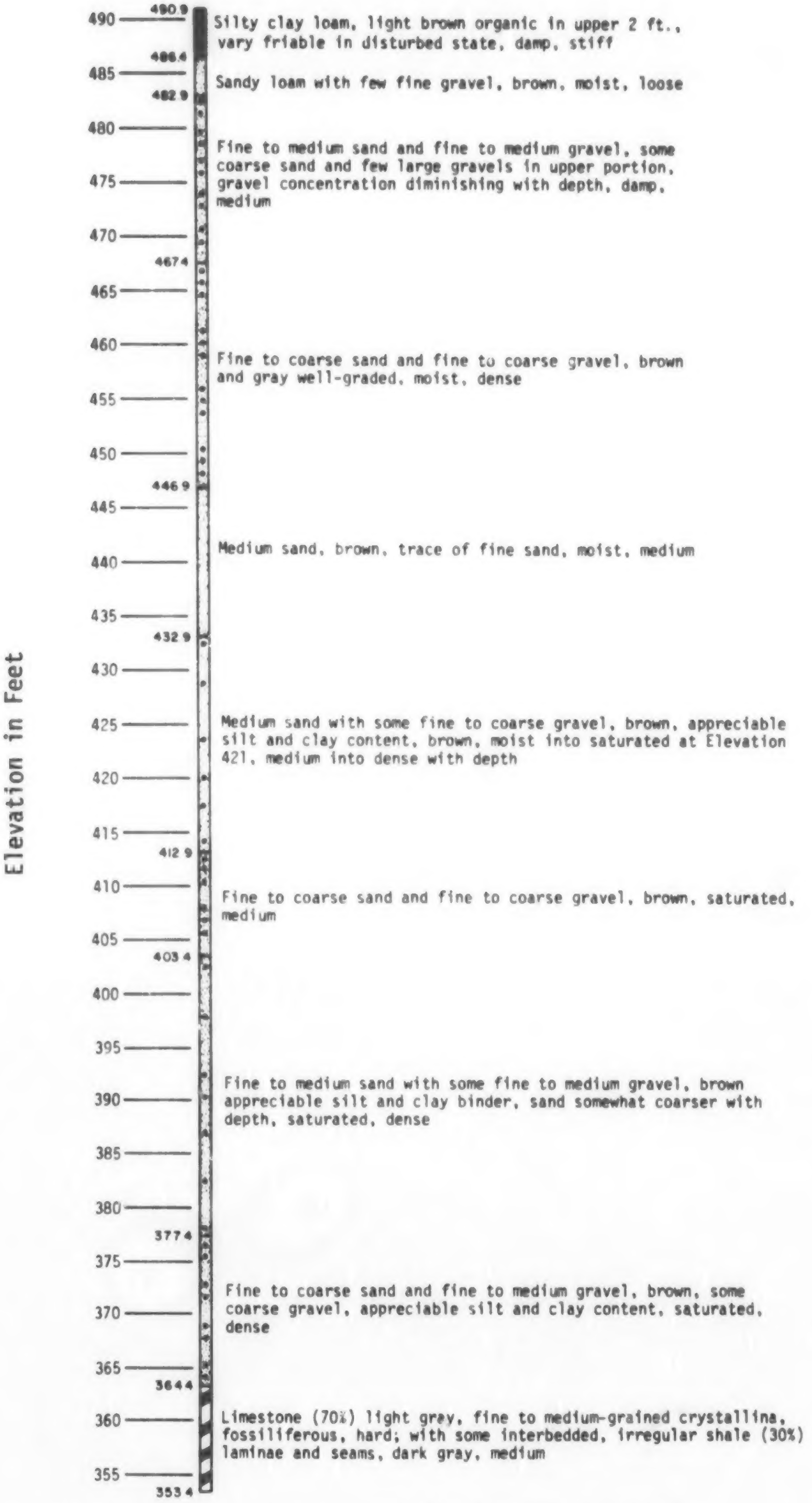
8. Interior Low Plateau Province
   - a. Highland Rim section
   - b. Bluegrass section
   - c. Nashville Basin
   - d. Shawnee section

The present land use of the area greatly influences the distribution and abundance of vegetation and wildlife. Tobacco, corn and other crops are grown on the most level lands. Pasturelands are on gentler slopes rising from the floodplain to the steeper hillsides. Cut-over forests occupy most of the steeper slopes; however, almost untouched stands of hardwood timber are found in limited areas on the steepest slopes. Counts of annular rings on stumps of trees recently felled for power-line right-of-way construction showed the larger individuals of several dominant species to be 200 years old or more. The patchwork of variation in land use provides excellent habitat for "edge" species. These edge species (e.g., those animals thriving where two or more vegetation types come together) are the most abundant and commercially significant wildlife resource. They include such animals as cottontailed rabbits (*Sylvilagus floridanus*), white-tailed deer (*Odocoileus virginianus*), bobwhite (*Colinus virginianus*), and raccoons (*Procyon lotor*). Species associated with extensive stands of the original forests, for example gray squirrels (*Sciurus carolinensis*), are not benefitted by such interspersion of types and will disappear with more intensive land use. Rabbits, bobwhite, mourning doves (*Zenaida macroura*) and white-tailed deer frequently utilize crops to supplement their normal diet (Gusey and Maturgo 1973), and certain farming practices may be beneficial to these species.

2.1.3.1 Flora

2.1.3.1.1 Regional Vegetation

The Ghent Station is located in a transition region called the Western Mesophytic Forest Region (Braun 1950). This region is bounded on the east by the western escarpment of the Cumberland and Allegheny Plateaus and extends to the loess bluffs of the Mississippi River. The region extends from the southern boundary of the Wisconsin glaciation in Ohio and Indiana, southward to northern Alabama and Mississippi. Fenneman (1938) calls this region the Interior Low Plateau (Figure 2.1-8), which includes four subdivisions.



Silty clay loam, light brown organic in upper 2 ft., vary friable in disturbed state, damp, stiff

Sandy loam with few fine gravel, brown, moist, loose

Fine to medium sand and fine to medium gravel, some coarse sand and few large gravels in upper portion, gravel concentration diminishing with depth, damp, medium

Fine to coarse sand and fine to coarse gravel, brown and gray well-graded, moist, dense

Medium sand, brown, trace of fine sand, moist, medium

Medium sand with some fine to coarse gravel, brown, appreciable silt and clay content, brown, moist into saturated at Elevation 421, medium into dense with depth

Fine to coarse sand and fine to coarse gravel, brown, saturated, medium

Fine to medium sand with some fine to medium gravel, brown appreciable silt and clay binder, sand somewhat coarser with depth, saturated, dense

Fine to coarse sand and fine to medium gravel, brown, some coarse gravel, appreciable silt and clay content, saturated, dense

Limestone (70%) light grey, fine to medium-grained crystalline, fossiliferous, hard; with some interbedded, irregular shale (30%) laminae and seams, dark gray, medium

Figure 2.1-7. Ghent Station Soil Borings.

2.1.2.3 Soils

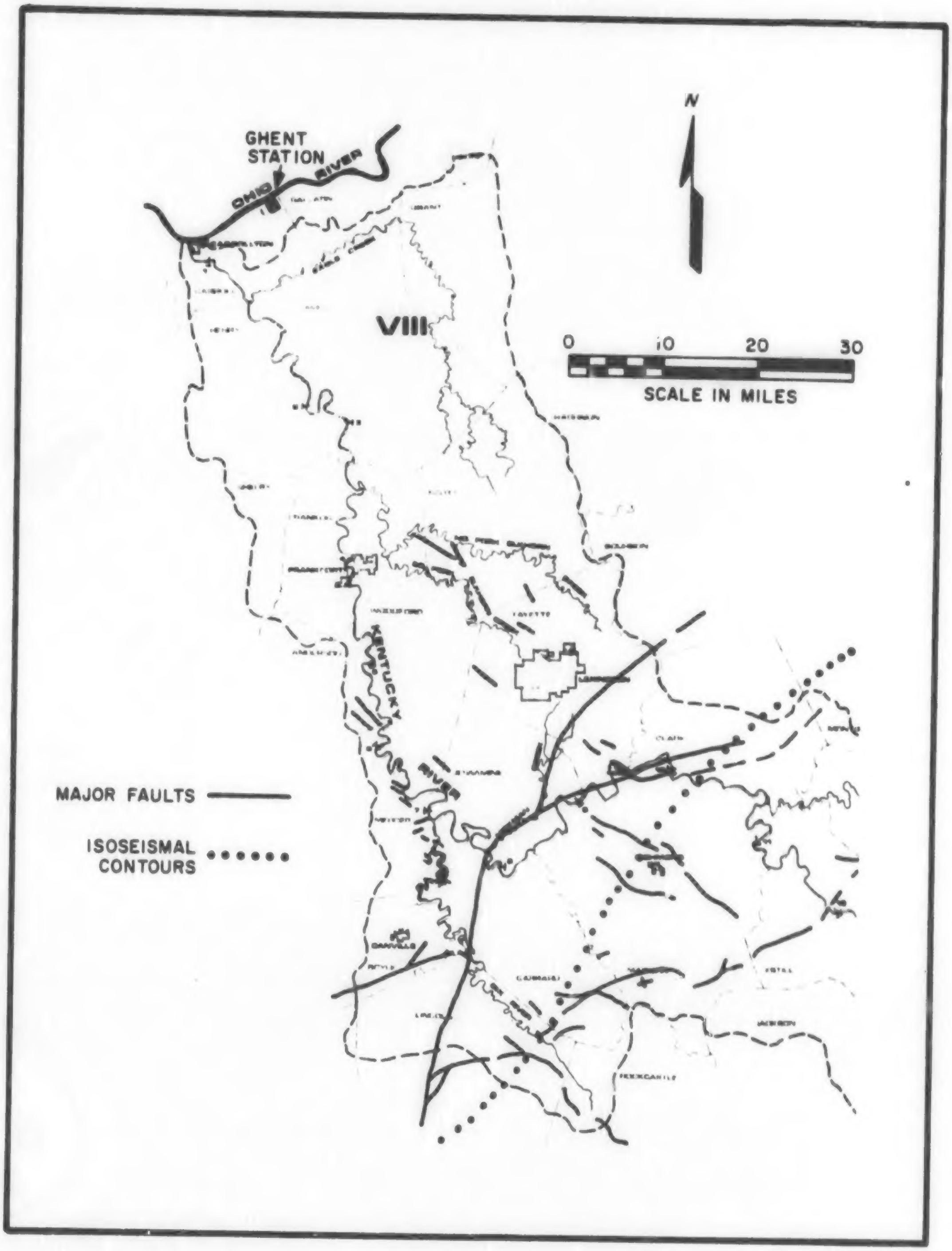
The area in which the Ghent Station is located is characterized as the Bluegrass area. The soils have developed in weathered Ordovician limestone, overlain in places, by loess mantle. Much of the truck and fruit crops of Kentucky are produced in the Bluegrass region in the counties bordering the Ohio River. Chief crops are corn, tobacco, small grains and truck and fruit crops. Livestock production is also important (Bailey and Winsor 1964).

The principal soil series for this area are the Eden, Nicholson and Lowell. Eden soils are the most extensive, characterized by limestone flags, clayey textures with rapid run-off, and are best suited to pasture and hay (Bailey and Winsor 1964). The soils of the bottoms and terraces near the Ohio River are mostly of the Captina and Wheeling series. These soils formed an old alluvium that washed from soils of limestone origin. They are noted for a brittle hardpan at a depth of about 18 to 26 inches and are generally strongly acid, but respond well to liming and fertilizer (U.S. Army Engineer District, Louisville 1975).

Sargent and Lundy Engineers have performed soil borings at the Ghent Station. Figure 2.1-7 illustrates the log of a soil bore that was made at the location of planned construction for Units 3 and 4. Surface soils in the construction area generally consist of silty clay loam at the surface and progress into sandy loam at depths of 3 to 5 ft. From this depth until bedrock is reached at approximately the 130 ft depth, soils consist of varying ratios of sand, gravel and clay.

2.1.3 Terrestrial Biota

The area surrounding the Ghent Power Station, like much of Kentucky, was once a luxuriant hardwood forest. Migration to Kentucky by white settlers in the late 18th century and later, was followed by rapid removal of forests on much of the arable land (Wharton and Barbour 1973). The level land on the floodplain immediately surrounding the Ghent Power Plant was probably converted early to farmland, the gentler slopes were cleared for pastureland, and only the steep hillsides remained forested.



Source: U.S. Army Engineer District, Louisville 1975.

Figure 2.1-6. Fault lines of Northern Kentucky River Basin.

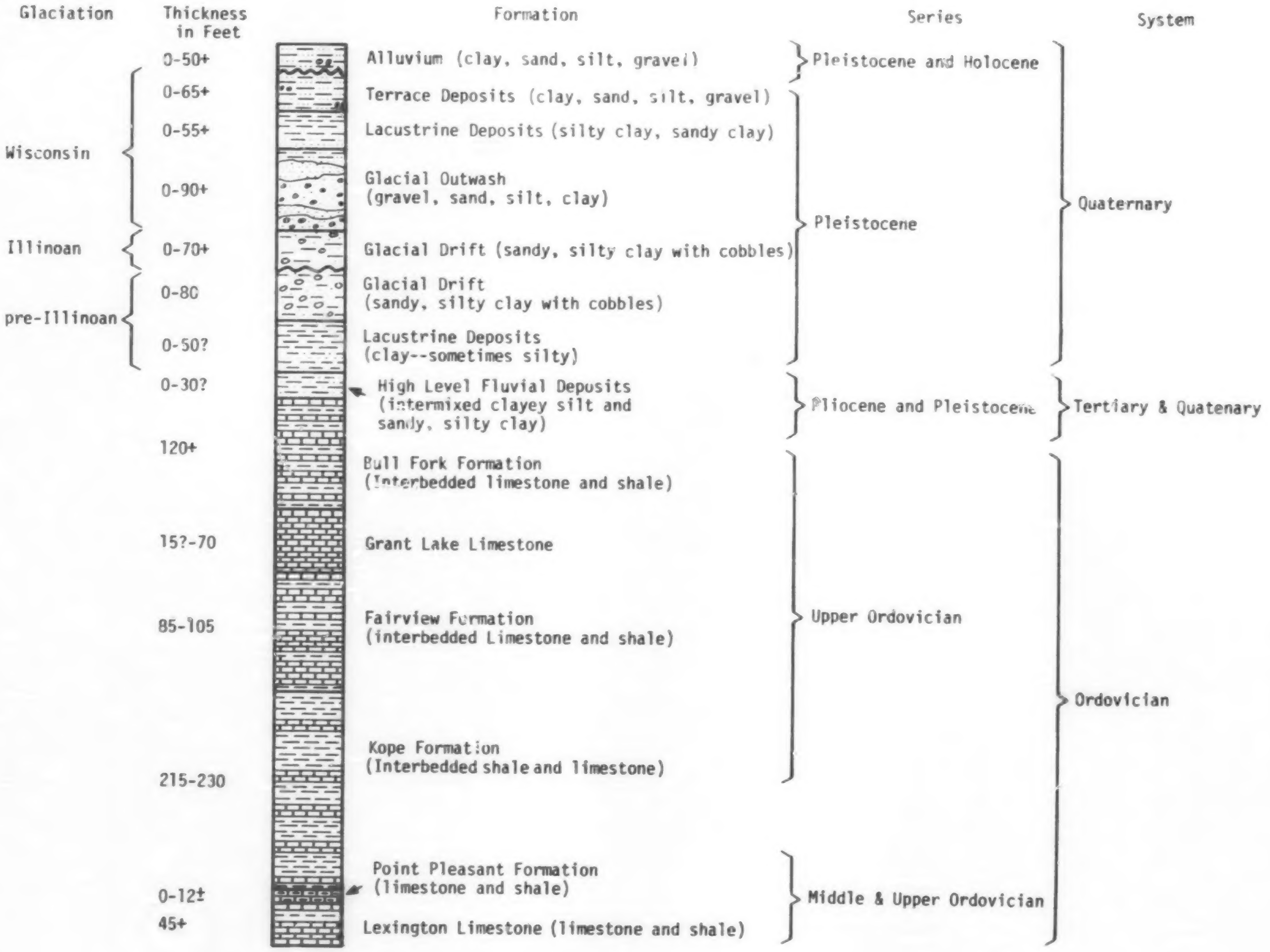

Glaciation
Thickness in Feet
Formation
Series
System
0-50+
Alluvium (clay, sand, silt, gravel)
Pleistocene and Holocene
0-65+
Terrace Deposits (clay, sand, silt, gravel)
0-55+
Lacustrine Deposits (silty clay, sandy clay)
Wisconsin
0-90+
Glacial Outwash (gravel, sand, silt, clay)
Pleistocene
Quaternary
Illinoan
0-70+
Glacial Drift (sandy, silty clay with cobbles)
0-80
Glacial Drift (sandy, silty clay with cobbles)
pre-Illinoan
0-50?
Lacustrine Deposits (clay--sometimes silty)
0-30?
High Level Fluvial Deposits (intermixed clayey silt and sandy, silty clay)
Pliocene and Pleistocene
Tertiary & Quaternary
120+
Bull Fork Formation (Interbedded limestone and shale)
15?-70
Grant Lake Limestone
85-105
Fairview Formation (interbedded Limestone and shale)
Upper Ordovician
Ordovician
215-230
Kope Formation (Interbedded shale and limestone)
Point Pleasant Formation (limestone and shale)
0-12±
Middle & Upper Ordovician
45+
Lexington Limestone (limestone and shale)

Figure 2.1-5. Generalized Columnar Section, Carroll County.

2.1.2.1 Site Geology

A generalized columnar section of the rocks and other materials underlying parts of the North and South Vevay Quadrangle, from Pleistocene alluvium at the surface, to the middle Ordovician series is shown in Figure 2.1-5 (Hall and Palmquist 1960).

The oldest exposed rock in the Ghent area is of the Lexington group and consists of 80 to 90 percent limestone with minor shale. The floodplain where the Ghent plant is situated consists of glacial outwash and alluvium deposits. Glacial outwash consists of interbedded gravel, sand, silt and clay which filled the Ohio River Valley to an elevation of 510 ft M.S.L. in the Ghent Station vicinity. Well records indicate outwash of Wisconsin age and possibly some underlying outwash of Illinoian age attain a total thickness of 120 ft at Ghent (Price 1964). Alluvial deposits consisting of clay, silt, sand and gravel are found on both erosional and depositional outwash terraces below the highest Wisconsin terrace level.

The hill slope directly behind the Ghent Station consists of interbedded shale and limestone of the Kope Formation between the elevation of 490 and 670 ft M.S.L., interbedded limestone and shale from the Fairview Formation between 670 and 750 ft M.S.L., and various combinations of limestone and shale of the Grant Lake limestone and Bull Fork Formation above 750 ft M.S.L. elevation. Also present above the 750 ft elevation are several areas of glacial drift and lacustrine deposits (Swadley 1973).

2.1.2.2 Seismic Risk

The Ghent Station is located in an area of relatively low seismic risk, rated as zone 1 on the U.S.G.S. Seismic Risk Map of the United States (U.S. Army Engineer District, Louisville 1975). However, an area 35 to 95 miles southeast of Ghent does exhibit extensive faulting and is potentially more active than any but the southwest parts of Kentucky (Figure 2.1-6). In the event of a recurrence of an earthquake of the intensity of the New Madrid earthquake of 1811-1812, the Ghent region would be VIII on the modified Mercali System of 1931. This rating is enough to affect the steering of motor cars and produce slight damage in specially designed structures, considerable damage in substantial buildings and great damage to poorly built structures.

2.1.2 Land and Topography

The Ghent Station is located in Carroll County in northern Kentucky adjacent to the floodplain of the Ohio River. Physiographers (Fenneman 1938) generally call this region the Hills of the Bluegrass Region, and include the Ghent Station locality in the Outer Bluegrass Region.

The Outer Bluegrass Region is a strongly dissected area of steep hillsides and narrow crested ridgetops (Bailey and Winsor 1964). Stream valleys are constricted and meandering, indicating mature dissection. Elevation in the county ranges from 420 ft M.S.L. on the floodplains to 700 ± ft M.S.L. at ridgetops.

Ghent Station is located in the pre-glacial Kentucky River Valley (Campbell et al. 1974). Fluvial deposits form well-developed terrace remnants 40-80 ft above the present floodplains, which cap bedrock spurs extending out from the sides of the present valley. The southerly advance of the glacial ice probably covered the Ghent Station locale, although the southerly boundary at this point is inconclusive. During the glaciated period Eagle Creek (south of Ghent) and the present-day Ohio River were formed and the pre-glacial Kentucky River was filled with outwash and till between Carrollton and Lawrenceburg (Campbell et al. 1974).

The Ghent Station is located on the Cincinnati Arch which extends from Tennessee through Kentucky and along the Indiana-Ohio line, and divides with its western portion extending into northwestern Illinois and its eastern portion extending beyond eastern Michigan and into Canada. The station is located more specifically on the northwestern corner of the Jessamine Dome. This dome is approximately 80 miles wide and 120 miles in length, and is located primarily in central Kentucky, extending into southeastern Indiana and southwestern Ohio.

Hard surface rocks in the Ghent Station area are composed of limestone, calcareous shales, and siltstones of the Upper Ordovician series (Jillson 1928). Alluvium and glacial till consisting of sand and gravels, and silts of Recent and Pleistocene Age are found in all the floodplains.

Table 2.1-7

Ambient Air Quality

Measured Concentrations of Total Suspended Particulates
($\mu g/m^3$)

Air Quality Monitoring Station	Monitoring Period	Number of Samples	Annual Arith. Mean	Annual Geo.* Mean (75/60)**	Maximum 24 hr Avg. (260/150)**
a) Carrollton	1/74-12/74	60	55	50	120
	1/75-12/75	57	53	48	166
b) Ghent	1/74-12/74	61	48	43	148
	1/75-12/75	55	41	38	102

* Geometric

** Kentucky Primary TSP/Secondary TSP Standards.

Measured Concentrations of Sulfur Dioxide
($\mu g/m^3$)*

Air Quality Monitoring Station	Monitoring Period	Number of Samples	Annual Arith. Mean (80/60)**	Maximum 24 hr Avg. (365/NA)**	Maximum 3 hr Avg. (NA/1300)**
a) Carrollton	1/74-12/74	60	16.4	139.0	-
	1/75-12/75	56	16.1	119.1	-
b) Ghent	1/74-12/74	450	12.0	110.0	264.6
	1/75-12/75	447	8.2	36.7	110.0

* 24 hr Bubbler Method.

** Kentucky Primary SO_2/Secondary SO_2 Standards.

Measured Concentrations of Nitrogen Dioxide
($\mu g/m^9$)

Air Quality Monitoring Station	Monitoring Period	Number of Samples	Annual Arith. Mean
a) Carrollton	1/74-12/74	60	19.2
	1/75-12/75	58	17.5
b) Ghent	1/74-12/74	59	14.8
	1/75-12/75	55	14.1

SO_2 is considered as not high enough to significantly affect the results of the computer modeling of the emission from the Ghent Station. As can be seen, all SO_2 emission from local industry is less than 100 tons per year (EPA 1976).

The nearest existing fossil fuel plant to the Ghent Station is the Clifty Creek Plant at Madison, Indiana, 33.1 km west. Other proposed plants consist of the Wise Landing Plant 37.4 km west southwest in Trimble County and the East Bend Plant 23.5 km northeast in Boone County.

2.1.1.4.2 Ambient Air Quality and Area Sources

The State of Kentucky is divided into 9 Air Quality Control Regions (AQCR). The Ghent Station is located in the Cincinnati Interstate AQCR. Near the Ghent Station, in Carroll County, are located two air monitoring stations; one at the Ghent Elementary School and the other at the Carroll County Mid-school in Carrollton. These two stations monitor the ambient air quality in terms of total suspended particulates, sulfur dioxide and nitrogen dioxide on a daily basis. Table 2.1-7 presents results from calendar years 1974 and 1975 for these two stations. As noted, corresponding primary and secondary standards are printed in each column. Primary ambient air quality standards mean those levels of air quality which are necessary, with an adequate margin of safety, to protect the public health. Secondary ambient air quality standards mean those levels of air quality which are necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

Table 2.1-6

Industry Within 26 km Of The Ghent Station

	Distance from Ghent Station (km)	Particulates (Tons/Year)	Sulfur Dioxide (Tons/Year)
Carroll County, Kentucky			
Dow Corning	7.4	14	55
M & T Chemicals	10.4	55	0
Standard Oil Company	13.1	0	0
Gulf Oil Company	13.4	0	0
Consolidated Aluminum	13.5	24	0
Coo-Par Concrete	14.6	95	0
Ohio Valley Paving	19.8	39	0
Martin Marietta	21.2	290	0
Kawnee	22.4	2	0
Gallatin County, Kentucky			
Eaton Asphalt	13.7	17	0
Switzerland County, Indiana			
Tricounty Stone	21.6	21	0
Hilltop Concrete	25.7	60	0

2.1.1.4 Air Quality

This section describes the existing air quality including the factors directly affecting air quality in the area surrounding the Ghent Station. (Under Environmental Protection Agency's rules for prevention of significant air quality deterioration, dated 5 December 1974, all areas of the Nation are to be designated into classes with designated allowable deterioration.) The information in this section provides a baseline for the prediction of the air quality deterioration and the total concentrations of emissions near the Ghent Station.

2.1.1.4.1 The Study Area

The study area is defined as the area around the Ghent Station in which the possible effects of emissions resulting from the operation of the generating units are likely to occur. As a result of personal communication with the Air Quality branch of EPA Region IV, 14 May 1976, the study area is defined by a circle with a radius of 25 km and centered at the Ghent Station. During climatic conditions that lead to poor dispersion, maximum concentrations of plant emissions usually occur within 10 km of the plant. For this reason, a study area of 25 km from the plant is considered adequate for assessing the dispersion of emissions.

The land form within the study area is basically a river valley oriented northeast to southwest. The Ohio River in the study area is normally at an elevation of 420 ft M.S.L. with the sides of the valley reaching an elevation of 800 ± ft M.S.L. (see Section 2.1.2.1). The prevailing winds at lower elevations probably follow the river valley and are therefore from the southwest (less often from the northeast). At higher elevation the wind may occur from a greater variety of directions as it is not affected as much by terrain (see Section 2.1.1.1.2).

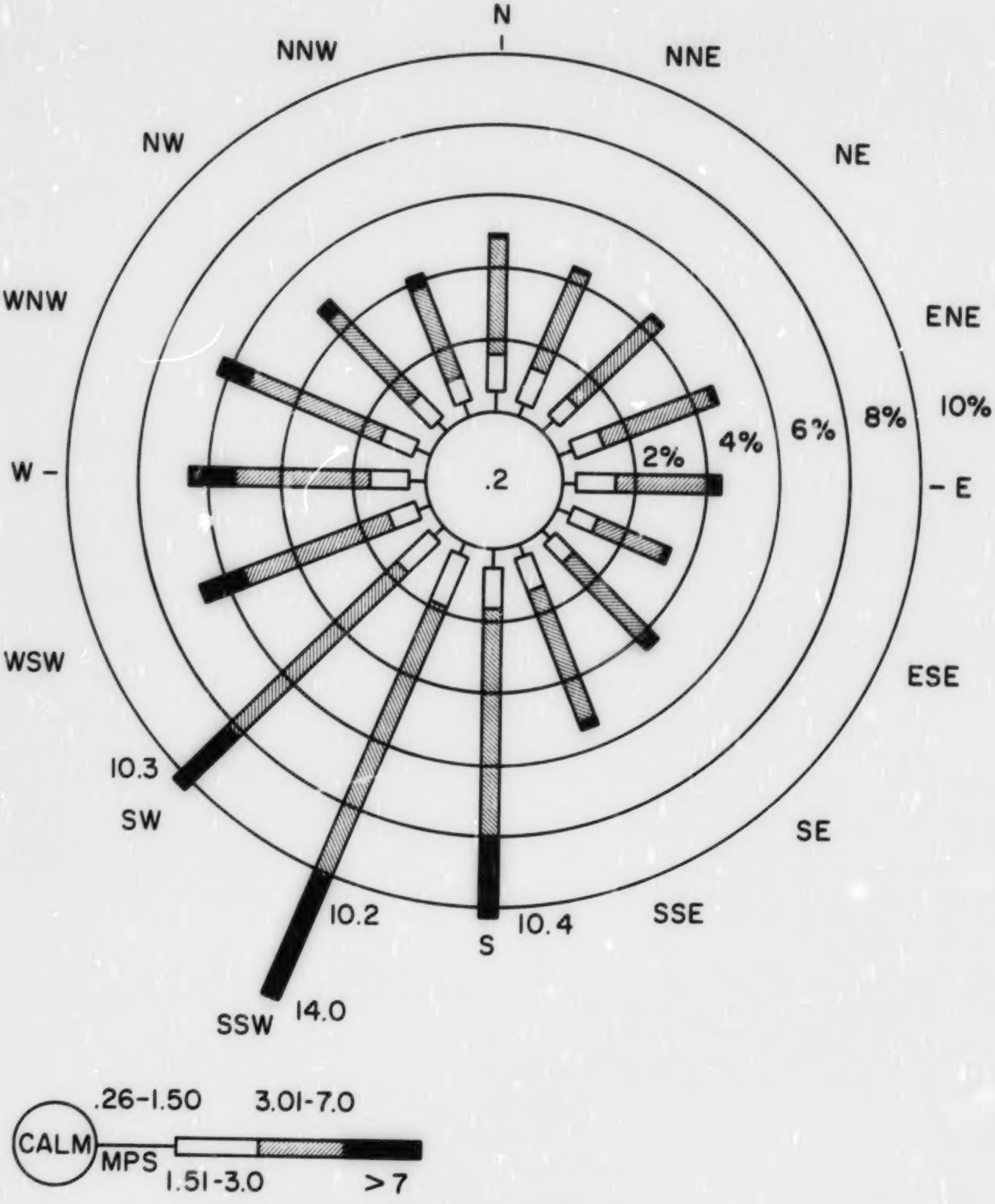
The study area is primarily an agricultural area (see Section 2.2.2). Local industry other than the Ghent Station that may affect air quality in the area are few in number with emissions lower than deemed significant to warrant including in an assessment of the Ghent Station. Table 2.1-6 presents all local industries in the study area and their emission rates. A rate of 100 tons per year or less of tions at Louisville for 24 years are presented below (Public Service Indiana 1975):

Stability Class	1949 to 1972 (%)
1 (A) (Least stable)	1.306
2 (B)	7.845
3 (C)	10.358
4 (D) (Neutral)	47.346
5 (E)	11.807
6 (F)	12.533
7 (G) (Most stable)	8.535

Mixing height, or the average depth of vigorous vertical mixing in the atmosphere, also greatly affects ground level concentrations of plant emissions. This height is diel in nature and gives an indication of the thickness of the atmospheric layer available for the mixing and dispersion of effluents. For the Louisville region, the seasonal average mixing heights for morning and afternoon in feet are (Public Service Indiana 1975):

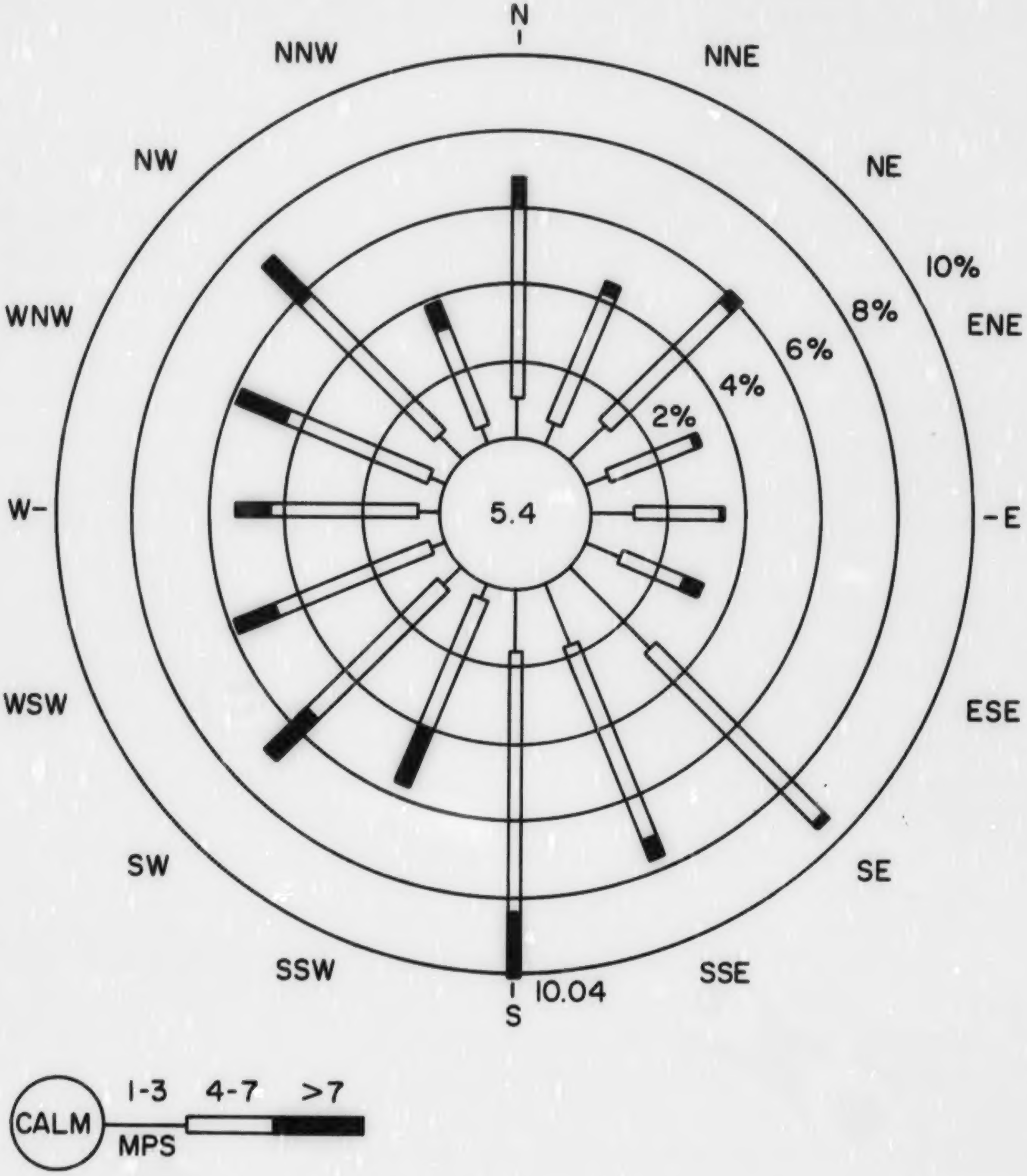
Season	Morning (feet)	Afternoon (feet)
Spring	650	1700
Summer	400	1800
Fall	390	1400
Winter	520	1000
Annual	450	1400

Source: Holzworth, G.C. 1972. Mixing heights, Wind Speeds and Potential for Urban Air Pollution Throughout the Contiguous United States, EPA, Research, Triangle Park, North Carolina.



Source: Public Service Indiana 1975.

Figure 2.1-4. January 1974 - December 1974 Wind Rose 199-Foot Level, Marble Hill.



Source: Public Service Indiana 1975.

Figure 2.1-3. Wind Rose--Louisville, 1949-1972.

> *Substation bus was re-energized from Ohio Power via Kenton, allowing use of the station reserve auxiliary transformer for re-starting the unit. At 10:54 PM, the Ghent unit was synchronized and began supplying power to the system as fast as permitted by the restoration of lines.*

2.1.1.3 Dispersion Climatology

Factors which effect ground level concentrations of plant emissions are wind speed and direction, atmospheric stability and atmospheric mixing height. Wind data are available from the Louisville Climatic Station for a 24-year period record, 1949-1972 and from Public Service of Indiana at the proposed Marble Hill Station site for the period January 1974 through December 1974. Wind direction, as recorded at the Louisville Climatic Station, 1949-1972, indicates that prevailing winds are from the south; however, significant distribution of wind frequencies from other directions is indicated. The wind is from the east-northeast the least amount of time (Figure 2.1-3).

On-site data from the Marble Hill Station for the calendar year 1974 indicates findings similar to Louisville with the dominant wind occurring from the south-southwest direction. The 1-year data from the Marble Hill Station indicate more of a valley effect on the wind direction than the Louisville data (Figure 2.1-4). This valley effect could also be the case at Ghent where the topography of the site is similar to the Marble Hill Site. The Ohio River at the Ghent Station runs from northeast to southwest. The river orientation causes a shifting of dominant wind direction, as noted at Louisville, to be more from the southwest at lower elevations.

The "fastest mile" of wind (the fastest average wind speed over any one mile of travel by the wind) at Louisville occurred from the northwest at 61 miles/hour in February 1967. The fastest mile recorded at the Cincinnati Climatic Station occurred from the south-southwest at 40 miles/hour in December 1973.

Atmospheric stability is a measure of the resistance of the atmosphere to mix vertically, due to temperature and density differences. The relative percentage frequencies of occurrence for the seven stability classes based on surface observa-

Kentucky is subject to a rather high probability of tornado occurrence, constituting a major meteorological feature for this region. High winds and specifically tornadoes can cause severe damage to transmission lines, generating stations or transmission substations, either by direct wind damage or by secondary damage due to electrical overloading of transmission lines.

On April 3, 1974, a major tornado outbreak occurred in central and northern Kentucky. The following is an excerpt from the Kentucky Utilities Company report of damages to the system and specifically the effect on the Ghent Station.

> *During the afternoon and evening of April 3, 1974 several tornadoes swept through central and northern areas of Kentucky causing extremely heavy damage to transmission lines of the Kentucky Utilities Company (KU) and East Kentucky Power Cooperative (EK). Generating Stations were undamaged, but since a large proportion of the lines of the bulk power network in the area were damaged to some extent, there was insufficient transmission capability to deliver adequate power into the central area of the system. Consequently, generators which were operating in that area became overloaded and were taken off to avoid damage, completing a general outage which lasted approximately seven hours. The approximate number of customers affected was 181,000 and the normal load in the affected area for the following day was estimated to be 530 megawatts (MW).*
>
> *Ghent Station. The first major unit to be taken off was Ghent #1 (500 MW) at 7:29 PM. Chart recorder outputs indicate that after all major transmission lines into the station were down except the Kenton and Boone 138 kV lines, a period of steady state instability existed in which the remaining lines were unable to carry the full output of the unit. For a period of approximately three minutes at 7:25 PM the unit output swung between 370 and 530 MW, then dropped suddenly and again swung for a period of about three minutes between 50 and 200 MW. All the while, frequency was swinging between 58.5 and 61.5 Hz. These power swings coincide closely with similar though less severe action at Brown Station. The indications are very strong that during this period, when a "Beat frequency" of light intensity was observed, that the Ghent unit was losing synchronism with the rest of the system. Boiler conditions and control system limits made it necessary to take the unit off at 7:29 PM to avoid damage. An auxiliary generator was able to supply power necessary for shutdown and protection of the unit until 8:44 PM when the Ghent*

The occurrence of fog in the Ghent area is not well documented. Occurrences of heavy fog (visibility of 1/4 mile or less) at Cincinnati and Louisville Climatic Stations are listed in Table 2.1-5.

Table 2.1-5

Heavy Fog Occurrences
(visibility 1/4 mile or less)
Cincinnati and Louisville Climatic Stations (12-year period), 1875

Months	Louisville	Cincinnati
January	1	3
February	1	2
March	1	2
April	0	1
May	0	1
June	0	1
July	1	2
August	1	3
September	1	4
October	2	3
November	1	2
December	1	3
Total	10	26

2.1.1.2 Severe Weather

Snow and ice damage to transmission lines is an ever present potential problem during winter months in Kentucky. To date, no major outage has resulted from this phenomenon within Kentucky Utilities system and the probability of a major outage is small.

The maximum 24-hour snowfall in the Cincinnati area was 9.8 inches, which occurred in March 1968. Louisville received a record 24-hour snowfall of 13.0 inches, November 1966. Monthly maximum snowfalls are 15.3 and 22.9 inches for Cincinnati and Louisville, respectively.

Snowfall in the Ghent region is quite variable from year to year. The total for an average year is estimated to be between 15 and 20 inches. In an average year, days with snow cover, equal to or greater than 1 inch, total 16; the average snowfall is about 3 inches.

The relative humidity for this region is lowest in mid-spring and highest in late summer. A daily maximum usually occurs in the early morning and a daily minimum occurs usually in the mid-afternoon. Table 2.1-4 presents the mean relative humidity percentages for a 13-year period of record at the Cincinnati Climatic Station.

Table 2.1-4

Relative Humidity Percentages
Cincinnati Climatic Station, 13-year Period

01 Hour	07 Hour	13 Hour	19 Hour
	(Local Time)		
75	78	66	69
73	77	63	64
73	78	61	61
71	76	54	55
75	78	53	56
80	81	55	58
82	84	56	60
83	88	56	62
83	88	58	68
77	83	54	64
75	79	63	69
77	79	69	72
77	81	59	63

Annual free-water evaporation, i.e., from shallow lakes and farm ponds, averages about 34 inches (about 8 inches less than mean precipitation). About 76 percent of this evaporation occurs during the 6-month period of May-October.

Table 2.1-2

Average Monthly Precipitation
Vevay, Indiana (1941-1970)

Month	Inches	Month	Inches
January	3.43	July	4.15
February	3.30	August	3.00
March	4.47	September	2.79
April	3.87	October	2.43
May	3.87	November	3.27
June	4.08	December	3.01

Annual Precipitation - 41.63 Inches

A statistical study of heavy precipitation in periods of 5 minutes to 24 hours is included in Table 2.1-3. Thunderstorms occur on an average of about 45 days each year. They are most frequent in the spring and summer months.

Table 2.1-3

Rainfall Frequency For Durations From 5 Minutes To 24 Hours And Return Periods From 2 to 100 Years For Carrollton, Kentucky (Values given in inches)

Return Period	5 Min	30 Min	1 H	6 H	12 H	24 H
2-year	0.4	1.1	1.4	2.2	2.7	3.1
10-year	0.6	1.6	2.0	3.2	3.8	4.2
25-year	0.7	1.8	2.3	3.6	4.2	5.0
50-year	0.8	2.0	2.6	4.0	4.7	5.4
100-year	0.9	2.3	2.8	4.3	5.2	6.0

For example: The 2-year 1-hour rainfall given in this table as 1.4 inches means that this value will be equalled or exceeded, on an average, once every 2 years.

Source: U.S. Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States.

Temperature extremes range from a maximum of 101F to a minimum of -20F. Monthly average temperatures range from a low of 33.3F in January to a high of 76.9F in July (Table 2.1-1)(NOAA 1975).

Table 2.1-1

Temperatures (F)

	Normal			Extremes			
	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year
				15*		15*	
J	42.0	24.5	33.3	73	1975	-20	1963
F	45.0	26.5	35.8	77	1972	-4	1966
M	54.0	34.0	44.0	83	1967	15	1969
A	66.9	44.8	55.9	88	1962	24	1972
M	75.6	53.9	64.8	91	1971	31	1966
J	83.7	62.9	73.3	97	1971	42	1966
J	87.3	66.4	76.9	101	1966	50	1972
A	86.8	64.9	75.9	101	1964	49	1965
S	80.5	57.7	69.1	96	1964	37	1965
O	70.3	45.9	58.1	89	1963	25	1962
N	54.9	35.1	45.0	82	1968	10	1964
D	44.1	27.1	35.6	73	1975	-3	1962
YR	65.9	45.3	55.6	101	July 1966	-20	Jan. 1963

Precipitation, at the Ghent Station, is fairly well distributed throughout the year. The month of October usually has the least rainfall and March the most. Table 2.1-2 presents average precipitation for the period of record 1941 to 1970 at an observation station at Vevay, Indiana. The average annual precipitation is 41.63 inches and ranges from a low of 2.43 inches in October to a high of 4.47 inches in March.

*Length of record in years.

2.1.1.1 Regional Climatology

The following is a narrative description of the climate of Louisville, Kentucky. Although the climate station is approximately 50 miles southwest of the Ghent Station, the climatic summary is generally applicable to the Ohio River Valley region.

> *The climate of Louisville, while continental in type, is of a variable nature because of its position in midlatitudes, in the belt of the westerly winds, in the path of cyclonic storms, and its location in the interior of the continent, but still not shut off from a great source of moisture, the Gulf of Mexico. Since highs and lows pass through this area, the temperature generally varies with the systems. Thus, in winter and summer, there are occasional cold and hot spells of short duration with quick moderation as the high pressure ridge moves off. As a whole, winters are moderately cold and summers are quite warm. Temperatures of 100F or more in summer and 0F or less in winter are rare. The city is so situated geographically as to receive rainfall from cyclonic storms which, particularly in the winter and spring, move along a path extending from Texas to New England. It is also situated so as to receive rainfall from storms which move across the continent from west to east. Thunderstorms with high intensities of rainfall are common during the spring and summer months. As a result, precipitation in Louisville is nonseasonal and varies from year to year, and month to month with the fall months usually the driest. Generally March is the month of greatest monthly rainfall and October of least monthly rainfall. Snowfall, while seldom heavy, is a usual occurrence during the months of November through March. As with rainfall, amounts vary from year to year and month to month. Some snow has also been recorded in the months of October and April. Mean total amounts for the months of December, January, and February are about the same with January showing a slight edge in total amount. Relative humidity remains rather high throughout the summer months. Cloud cover is about equally distributed throughout the year with the winter months showing somewhat of an increase in amount. The percentage of possible sunshine at Louisville varies from month to month with the greatest amount during the summer months as a result of the decreasing sky cover during that season. Heavy fog is unusual and there is only an average of 10 days during the year with heavy fog and these occur generally in the months of September through March. The average date for the last occurrence in the spring of temperatures as low as 32F is at the end of the first week in April; the occurrence of the first 32F reading in autumn is generally at the beginning of the last week in October. The prevailing direction of the wind has a southerly component and the velocity averages under 10 m.p.h. The strongest winds are usually associated with thunderstorms. (NOAA 1975)*

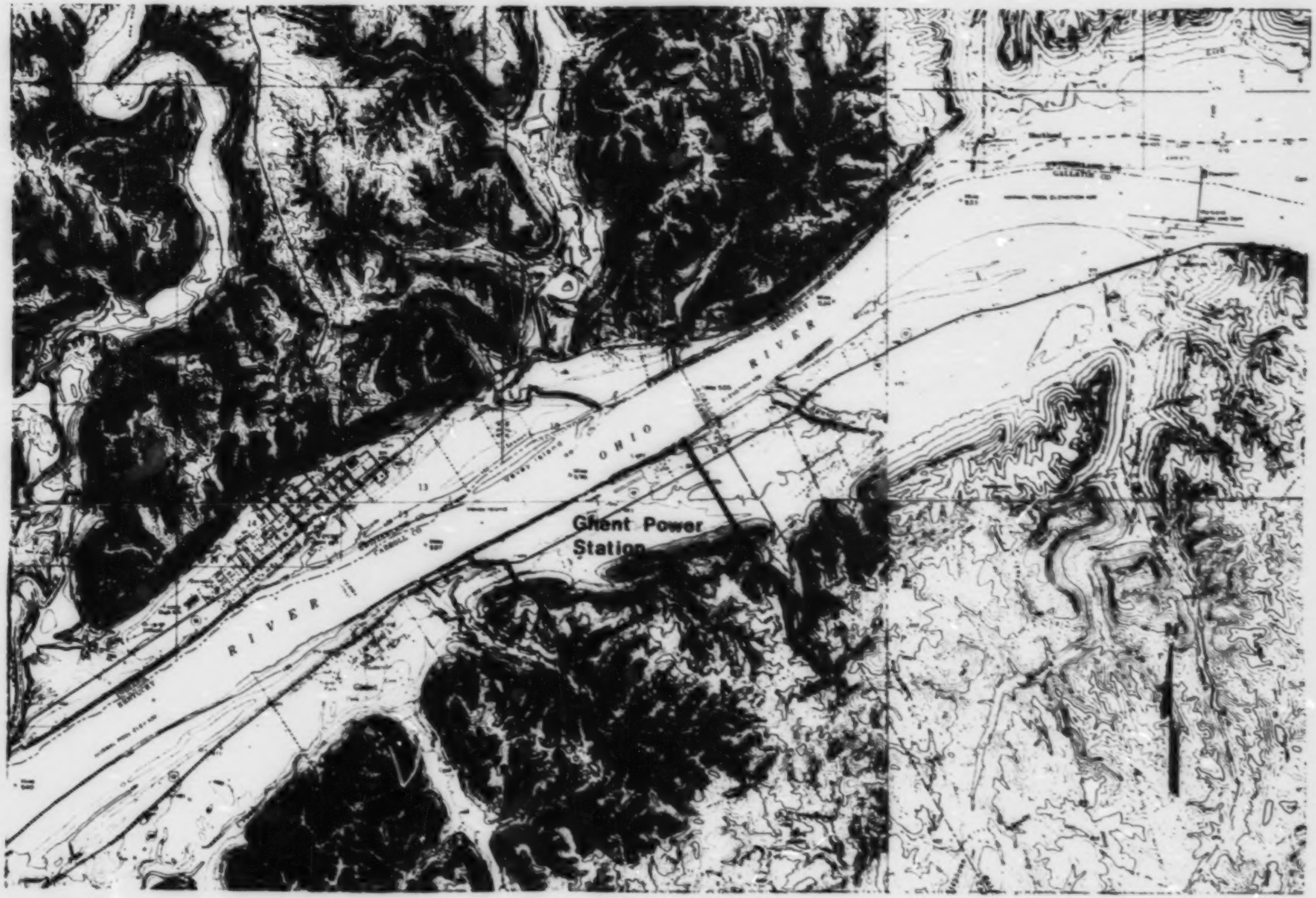


Figure 2.1-2. Ghent Station Terrain.

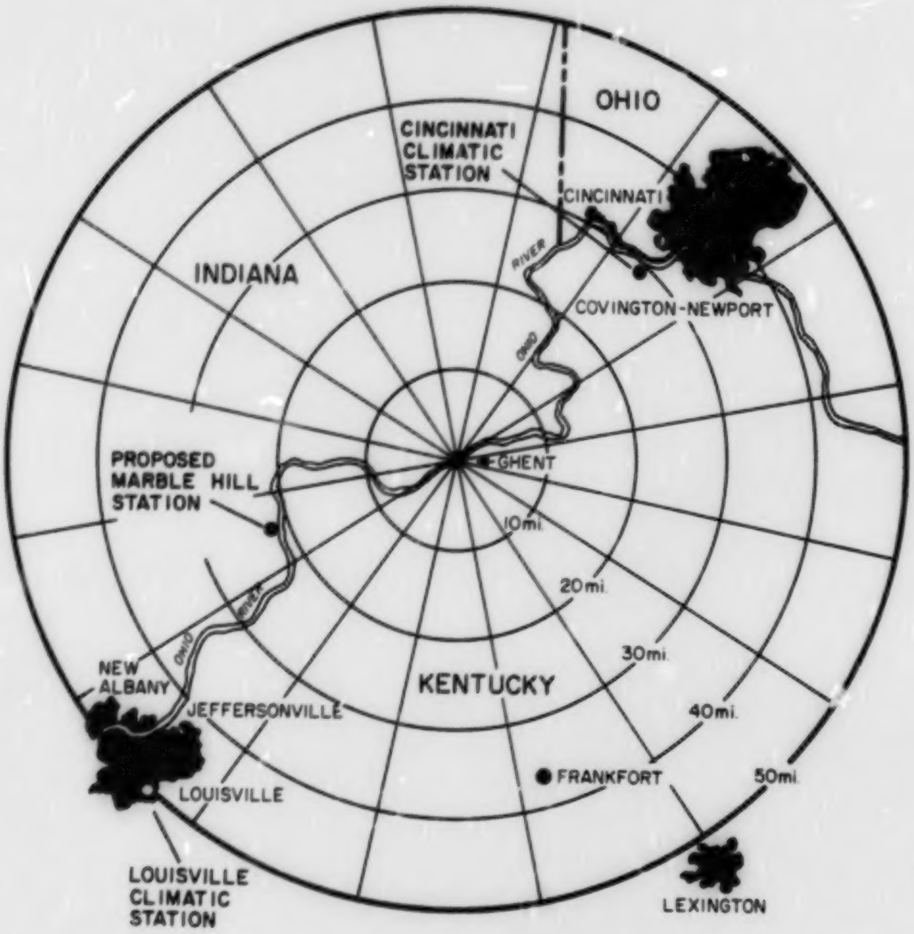


Figure 2.1-1. Weather Station Locations.

2.1 THE NATURAL ENVIRONMENT

2.1.1 Atmosphere

Information on atmospheric characteristics in the vicinity of Ghent as well as for the Kentucky Utilities service area are presented for two purposes:

- As inputs to the atmospheric dispersion model
- As parameters which may affect the structural integrity or operational ability of the plant and its peripheral elements.

Available meteorological data of direct concern to these purposes include air temperature, relative humidity (or dew point temperature), precipitation, wind and the occurrence of inversions, fog and severe weather.

No historical or current weather data are available for the Ghent site itself. However, information for Ghent and the Kentucky Utilities service area has been gathered from National Weather Service Stations at Louisville, Kentucky and Cincinnati, Ohio and from the Environmental Report for the proposed Marble Hill Nuclear Generating Station between Madison, Indiana and Louisville, Kentucky. Each of these data bases is applicable, in part, to the Ghent assessment, but will be used with some discrimination because of differences in topography, elevation. latitude and proximity to the Ohio River. Each of the stations whose data are cited is shown in Figure 2.1-1.

The Ghent plant site lies on a bluff along the left (south) bank of the Ohio River. Topographically, the Ohio Valley in this reach runs roughly northeast-southwest. The river, at a normal pool elevation of 420 ft, is approximately 1,500 ft wide; bluffs rise sharply to an elevation of 487 ft. Above the bluffs, the valley is relatively flat for a 1/2 mile distance between hilly terrain on both Indiana and Kentucky banks. These hills are generally 250 to 300 ft in height above the plain. The terrain in the vicinity of the plant, which is typical of the area, is shown in Figure 2.1-2. The topography is of concern primarily as it may affect local air movement. The occurrence of fog, and to some degree, air temperature and relative humidity, will also be affected by topography and proximity to the river.

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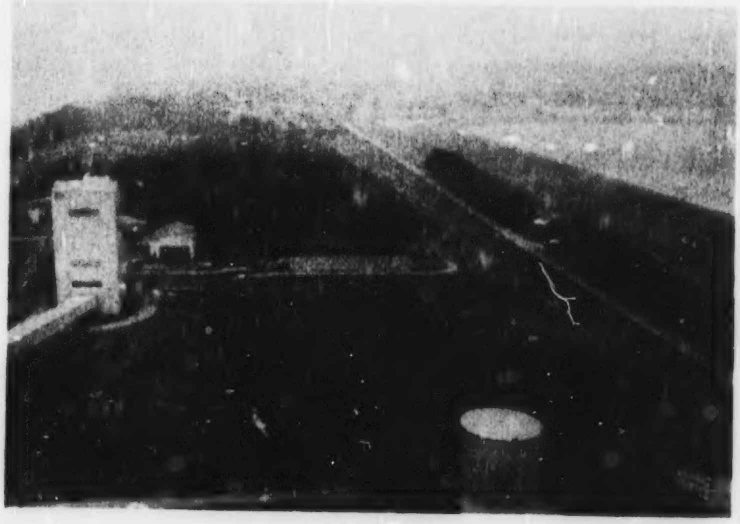
SECTION 2.0
THE ENVIRONMENT WITHOUT THE PROPOSED ACTION



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1.4 CONSEQUENCES OF DELAY

Any delay in the availability of the capacity of the proposed units will involve decreased system reliability to the extent that "brown-outs" may result. Kentucky Utilities's only option should the units be delayed would be to attempt to purchase power with no assurance that dependable power will be available. Even if such purchases could be made, the power would probably be from older less efficient units or peaking units, which coupled with the requirement to operate Kentucky Utilities' less economical, less efficient units at higher capacity factors would result in much higher overall system operating costs.

Construction delays will cause increased construction costs. The escalating cost of materials and wages, along with contract penalties, increase the total cost of the construction at a rate of approximately 9 percent per year.

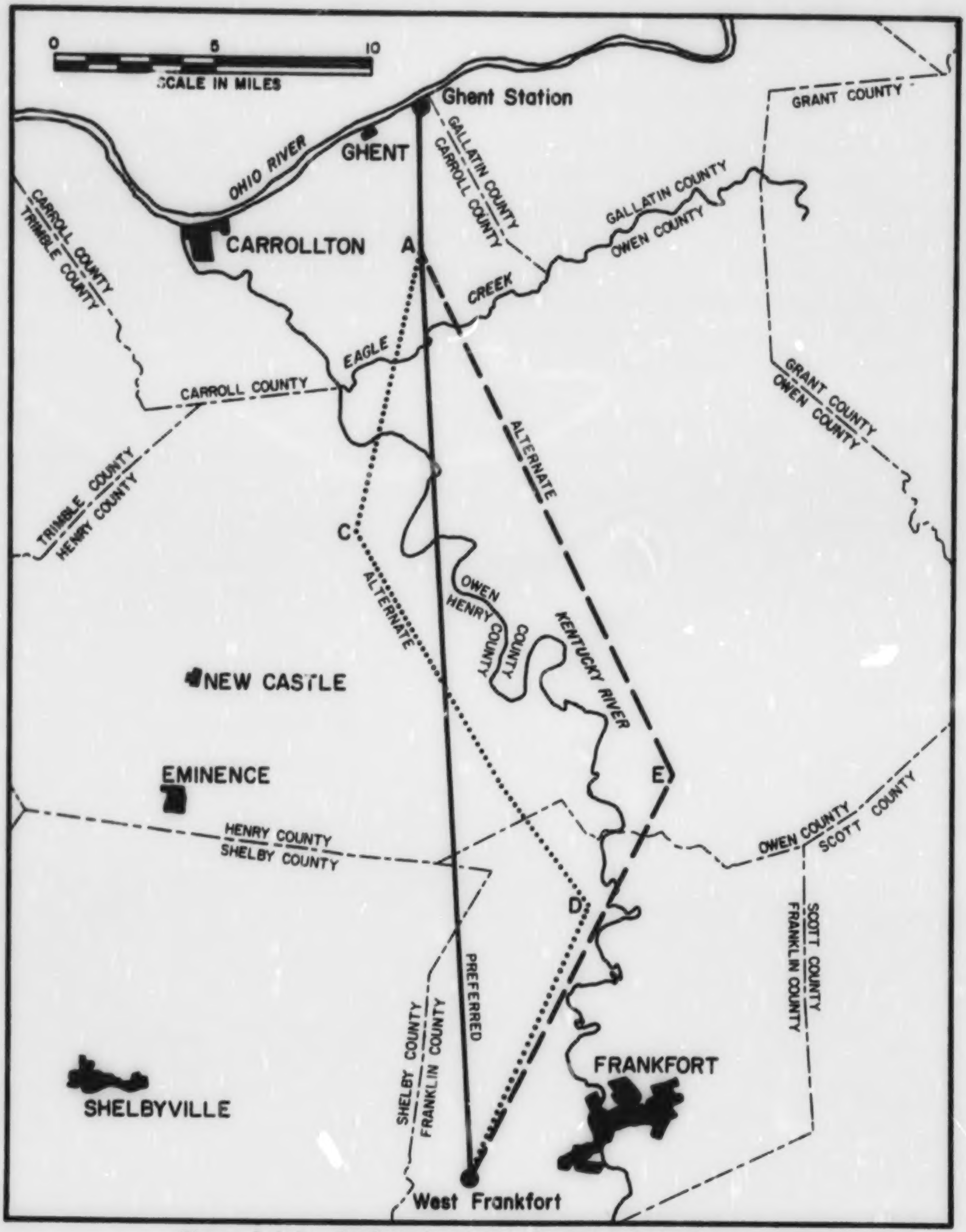


Figure 1.3-3. Preferred and two alternate transmission routes.

Table 1.3-1

Preliminary Construction Schedule
Ghent Station - Units 3 & 4

	Unit 3	Unit 4
Soil Borings	Mar. 1976 to Apr. 1976	Mar. 1976 to Apr. 1976
Site Work	July 1977 to May 1979	Jan. 1979 to Aug. 1979
Substructure	July 1977 to May 1979	June 1979 to Sep. 1980
Intake and Discharge Structures	Jan. 1978 to June 1979	--
Circulating Water Piping	Feb. 1978 to July 1978	Aug. 1979 to Aug. 1981
Structural Steel	July 1978 to Oct. 1979	Jan. 1980 to Apr. 1981
Chimney	May 1978 to July 1980	--
Gallery Work	Aug. 1978 to Oct. 1979	Mar. 1980 to June 1981
Siding	Sep. 1978 to July 1980	Apr. 1980 to Dec. 1980
Superstructure	Dec. 1978 to Jan. 1981	May 1980 to Sep. 1981
Condensing Equipment	Feb. 1979 to Nov. 1979	Sep. 1980 to June 1981
Mechanical Equip. Erection	Feb. 1979 to Nov. 1980	Sep. 1980 to Apr. 1982
Steam Generator	Feb. 1979 to Feb. 1981	Sep. 1980 to Nov. 1982
Feed Water Heaters	May 1979 to Aug. 1979	Oct. 1980 to Dec. 1980
HVAC	Apr. 1979 to Aug. 1980	Nov. 1980 to Oct. 1981
Station Piping	Apr. 1979 to Mar. 1981	Nov. 1980 to Nov. 1982
Electrical Work	Apr. 1979 to Apr. 1981	Nov. 1980 to Nov. 1982
Coal Handling	Aug. 1979 to Nov. 1980	Feb. 1981 to May 1982
Cooling Tower (mech)	May 1979 to Oct. 1980	Feb. 1981 to Aug. 1982
Precipitators	Aug. 1979 to Dec. 1980	Mar. 1981 to Mar. 1982
Switchyard	Oct. 1979 to Oct. 1980	May 1981 to May 1982
Turbine Generator	Dec. 1979 to Mar. 1980	July 1981 to Nov. 1982
Ductwork	Oct. 1979 to Sep. 1980	Aug. 1981 to May 1982
Thermal Insulation	Feb. 1979 to Mar. 1981	Sep. 1981 to Jan. 1983

Shaded areas on Figure 1.3-2 show the proposed siting for new construction for Units 3 and 4.

It is anticipated that the construction of the Ghent Units 3 and 4 will begin as soon as permits are issued thereby enabling the commercial operation of Unit 3 to begin in 1981 and of Unit 4 in 1983 (Table 1.3-1).

A new 345 kV transmission line will be constructed in order to insure the transmission of power in case of failure on the other lines. The right-of-way for new transmission lines will be to the south of Ghent to a point approximately 5 miles west of Frankfort, Kentucky. Proposed construction is to begin in 1981.

1.3.4 Description of Proposed Transmission Line Project

The EPA requires that environmental assessment work be performed on proposed transmission facilities associated with the construction of new source generating plants. The assessment work present in this EIS covers only the general area of the proposed Ghent Station transmission facilities since at this time no detailed routing work has been completed.

The proposed line will connect the 345 kV facilities at the Ghent plant to a substation approximately 5 miles west of Frankfort. The proposed route and two alternate routes (Figure 1.3-3) lie in an area 15 miles wide and 40 miles long. Self supporting lattice type steel towers with bundled (2 wire) 954 MCM 45-7 ACSR conductor and two 7-No. 8 AW overhead ground wires will be used in the line construction which will begin about May 1981 with completion in December 1982.

Figure 1.3-2 is a site drawing of the existing site at Ghent Electric Generating Station. Unshaded areas represent construction for Units 1 and 2.

1.3.3 Proposed Site Description

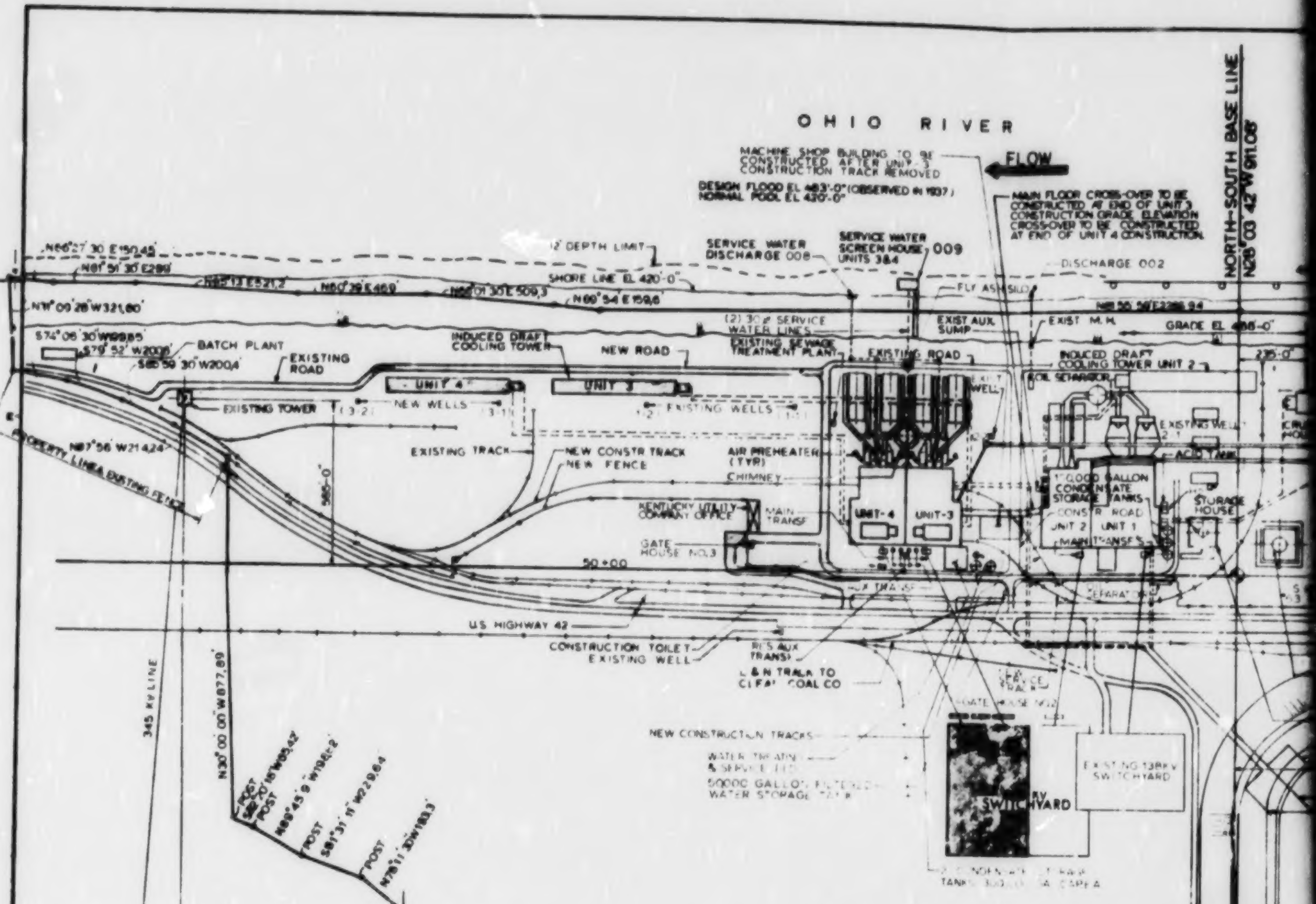
Kentucky Utilities Company plans to add two coal-fired electric generating units at its Ghent Power Station. This is a rational decision for the Company since the original plans for the Ghent Station included the construction of Units 3 and 4. The existing property of 632.7 acres is adequate to support the addition of the two new units without new purchases. Transmission lines are adequate to take the increased load from the additional units with one additional 345 kV transmission line in 1983.

The new units, each of which will have a capacity of 550 MW gross, will have a combined total electric generating capacity of 1,100 MW gross. Units 3 and 4 characteristics are:

Turbine generation rate	550 MW gross
Fuel	Coal--0.7% sulfur coal
Ash disposal method	Discharge into existing ash settling pond as modified
Particulate removal method	99.5% electrostatic removal systems
Stack height	660 ft above grade
Circulating water system	Closed cycle cooling system employing one mechanical draft cooling tower per unit

New construction to the existing site will include:

- One water intake structure
- One mechanical draft cooling tower per unit
- One stack
- Switch yard expansion
- Housing for boilers and turbines
- New road
- One warehouse
- Expansion of the existing coal yard
- Expansion of the coal conveyor system


OHIO RIVER
FLOW
MACHINE SHOP BUILDING TO BE CONSTRUCTED AFTER UNIT 3 CONSTRUCTION TRACK REMOVED
DESIGN FLOOD EL 483'-0" (OBSERVED IN 1937)
NORMAL POOL EL 420'-0"
MAIN FLOOR CROSS-OVER TO BE CONSTRUCTED AT END OF UNIT 3 CONSTRUCTION GRADE ELEVATION CROSS-OVER TO BE CONSTRUCTED AT END OF UNIT 4 CONSTRUCTION
NORTH-SOUTH BASE LINE N26°03'42"W 911.08'
12' DEPTH LIMIT
SERVICE WATER DISCHARGE 008
SERVICE WATER SCREEN HOUSE 009 UNITS 3&4
DISCHARGE 002
SHORE LINE EL 420'-0"
FLY ASH SILO
N60°27'30"E 150.45'
N81°51'30"E 289'
N80°13'E 521.2
N60°29'E 409'
N60°01'30"E 509.3
N60°54'E 159.6
N71°09'28"W 321.80'
(2) 30" SERVICE WATER LINES
EXISTING SEWAGE TREATMENT PLANT
EXIST AUX SUMP
EXIST M.H.
GRADE EL 458'-0"
S74°06'30"W 99.85'
S79°52'W 200'
S85°59'30"W 200.4'
BATCH PLANT
EXISTING ROAD
INDUCED DRAFT COOLING TOWER
NEW ROAD
EXISTING ROAD
INDUCED DRAFT COOLING TOWER UNIT 2
235'-0"
UNIT 4
UNIT 3
EXISTING TOWER
NEW WELLS
EXISTING WELLS
EXIST WELL
OIL SEPARATOR
EXISTING WELL
N87°56'W 214.24'
PROPERTY LINE & EXISTING FENCE
EXISTING TRACK
NEW CONSTR TRACK
NEW FENCE
AIR PREHEATER (TYP)
CHIMNEY
ACID TANK
100,000 GALLON CONDENSATE STORAGE TANKS
CONSTR ROAD
STORAGE HOUSE
585'-0"
KENTUCKY UTILITY COMPANY OFFICE
MAIN TRANSF
UNIT-4
UNIT-3
UNIT 2
UNIT 1
MAIN TRANSF'S
GATE HOUSE NO.3
50+00
AUX TRANSF
SEPARATOR
US HIGHWAY 42
CONSTRUCTION TOILET
EXISTING WELL
RES AUX TRANSF
L & N TRACK TO CLEAR COAL CO
SERVICE TRACK
GATE HOUSE NO.2
NEW CONSTRUCTION TRACKS
WATER TREATMENT & SERVICE BLDG
50000 GALLON FILTERED WATER STORAGE TANK
KV SWITCHYARD
EXISTING 138KV SWITCHYARD
CONDENSATE STORAGE TANKS 300,000 GAL CAPEA
345 KV LINE
N30°00'00"W 877.89
POST
N60°45'9"W 194.2
POST
S81°31'11"W 229.64
POST
N76°11'30"W 183.3
TOWER BASE
N29°37'26"W 1816.46'
WNW
NW
NNW
N
NNE
NE
ENE
W
WSW
SW
SSW
S
CALM
TOTAL % OF WINDS FROM INDICATED DIRECTION
STANDIFORD FIELD AIRPORT RECORDING STATION
CALM
VELOCITY METERS PER SECOND
1-3
4-7
>7
PROPERTY LINE SITE AREA
S62°28'41"W 3410.94'
3770'-0"
50+00

A

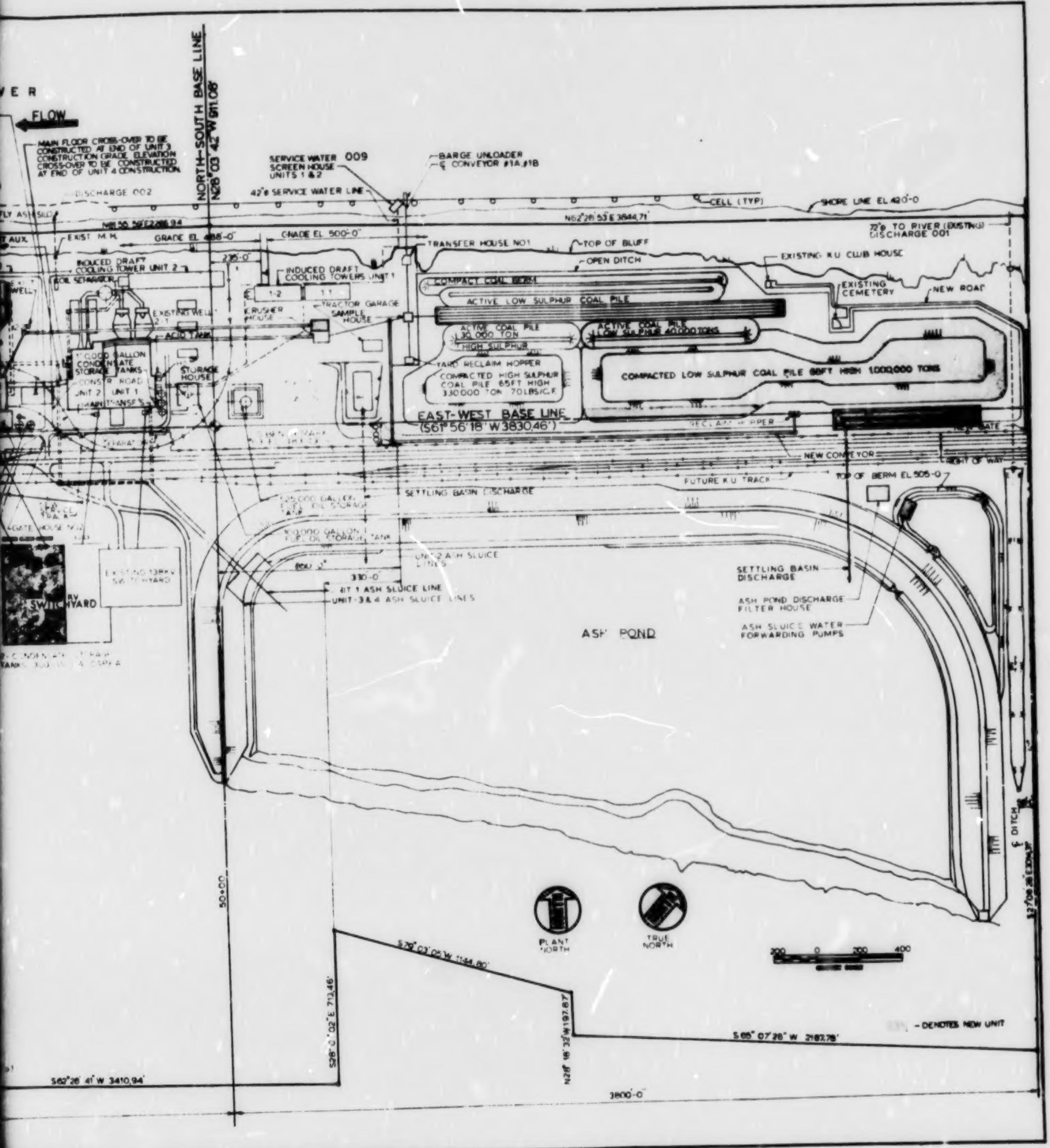


Figure 1.3-2. Plant site layout.

B

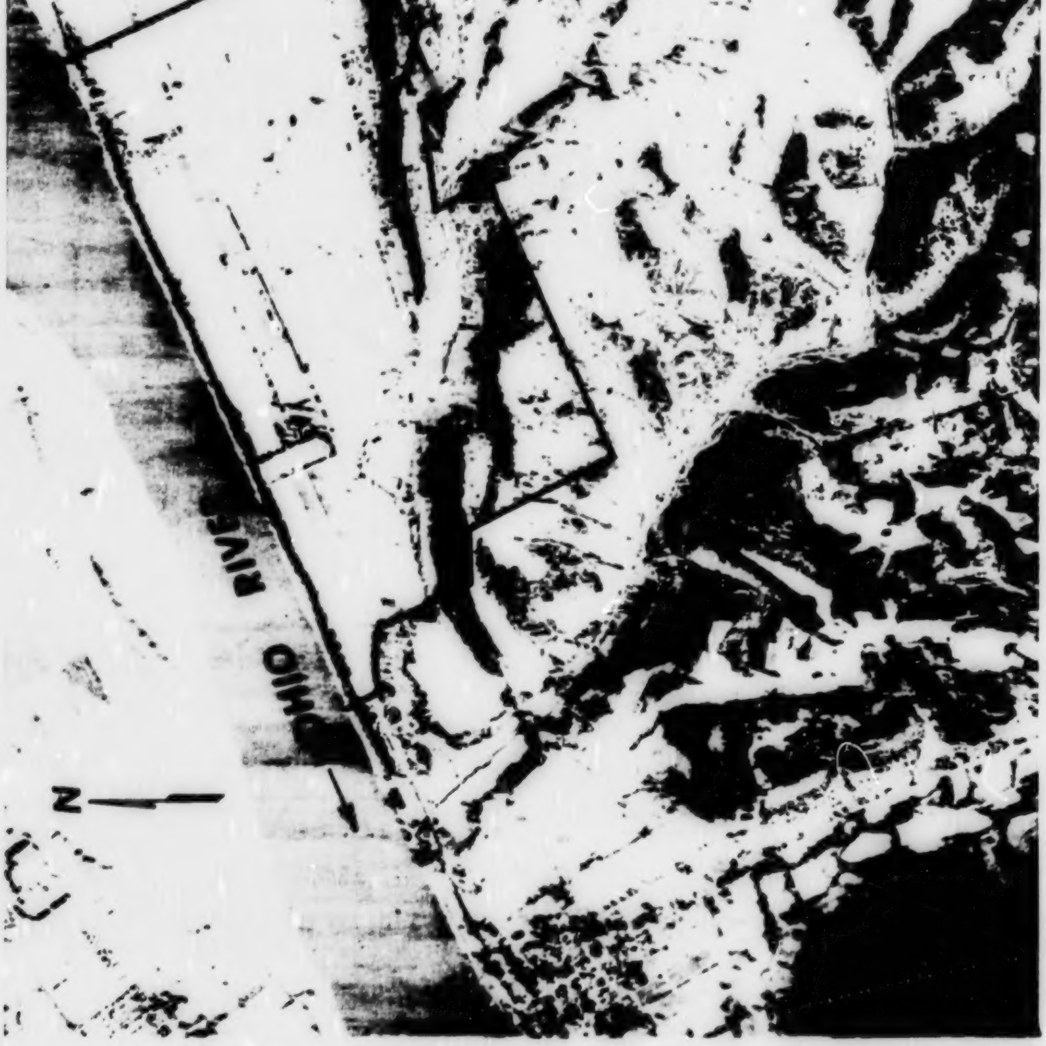


Figure 1.3-1. Ghent Power Station site before construction, 1967.

1.3 PROJECT SCOPE

1.3.1 Project History

The concept of the Ghent power plant began in 1950. The site was selected mainly for its location on the Ohio River. The Ohio River provides the essentials that make it ideal for the siting of power plants, in that it provides an abundance of water for cooling purposes and an economical means of transportation for fuel supplies. Land was purchased near Ghent in 1969. The site is located one mile northeast of Ghent, Kentucky, on the Ohio River at river mile 536.0. Figure 1.3-1 shows an aerial photograph of the site before any construction. The original plans were to have 4 coal-fired units with a combined gross electric generating capacity of 3,300 MW. Unit sizes were to produce 550 MW, 750 MW, 900 MW and 1,100 MW of power, respectively. Later, these plans were modified and all units were to produce 550 MW gross of electricity for a combined total of 2,200 MW gross. This decision came about because of other companies' experience with the poorer reliability of units with capacities greater than 600 MW.

1.3.2 Existing Site Description

Construction of Ghent's Unit 1 began in 1969 and the plant became operational in 1973. Construction for Unit 2 started in 1974 and the unit is expected to be operational in 1977. The characteristics of Units 1 and 2 are:

Turbine generating rate	550 MW gross
Fuel	Coal: Unit 1--3% sulfur coal Unit 2--0.7% sulfur coal
Coal handling system	Barge, railroad
Ash disposal method	Discharge into ash settling pond
Particulate removal method	Unit 1--98.5% electrostatic removal system Unit 2--99.0% electrostatic removal system
Stack height	660 ft above grade
Circulating water system	Closed cycle cooling system employing one mechanical draft cooling tower per unit

Construction of a second 345 kV line from Ghent to West Lexington was studied in some detail. Although this line would provide the required additional outlet at Ghent and support to the Lexington area, its construction would duplicate an existing line and provide no potential support for Frankfort and Shelbyville. These studies showed that these cities would need additional support by the mid 1980's.

Finally, the proposed route was investigated through comprehensive studies which determined that this line would provide the following: a) necessary additional power outlet at Ghent, b) required support in the Frankfort and Shelbyville area and c) several advantages to the system not evident by the other construction studied. Therefore, Kentucky Utilities concluded that the proposed line would be the best available route because it would require several million dollars less in terminal equipment and is approximately 12 miles shorter than the Ghent to West Lexington circuit; and termination near Frankfort provides not only support to the Central Area but also a possible future interconnection to LG & E's EHV system.

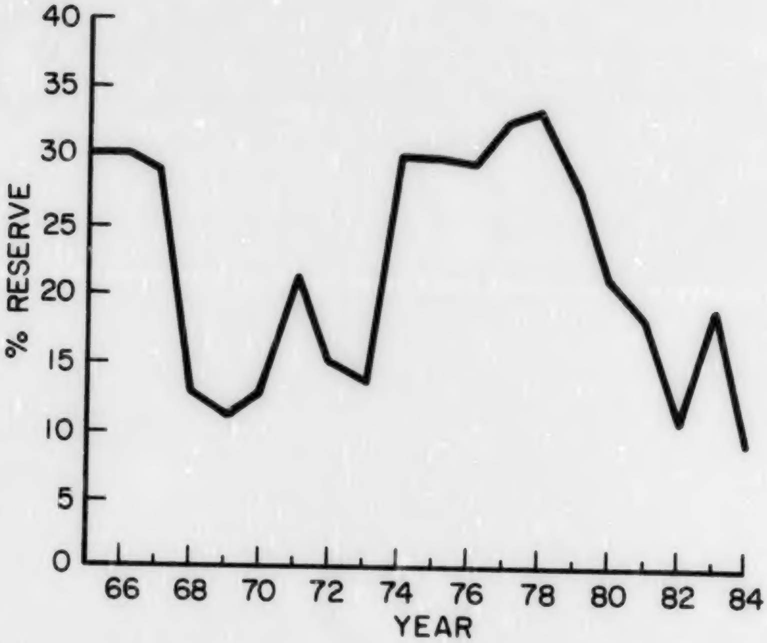


Figure 1.2-9. Kentucky Utilities Company percent reserve (as percent of peak load).

Figure 1.2-9 illustrates what reserve margins have been established in the past and what reserve margins have been estimated for the future. Due to Kentucky Utilities' relatively small but growing size, the reserve margins fluctuate widely when new units come on-line. In this regard, membership with KIP benefits small companies through reserve margin sharing. Companies with large reserves share with companies with small reserves until capacity meets system demand.

1.2.7 Transmission Line Rationale

Kentucky Utilities has shown through extensive loadflow and transient stability studies that no transmission lines will be required to incorporate Unit #3 into systems operations.

However, upon completion of Unit #4, there is indication for the need of an additional 345 kV line out of the Ghent Station. Justification for construction of this line is based on the following: a) loss of the double circuit 345 kV tower line carrying 2 circuits to Indiana results in overloads on several other facilities at or eminating from Ghent causing a cascading of facility outages with the resultant loss of the entire station, and b) increased EHV (extra high voltage) support is needed in the Company's Central Service Area territory, including Lexington and Frankfort.

Strengthening or duplicating of the Indiana tie facilities which may become overloaded would insure against the potential impact of this line outage, as would be true of constructing a 345 kV line to East Kentucky Power Cooperative's Spurlock Station, Cincinnati Gas and Electric's East Bend Station, or Louisville Gas and Electric's proposed station in Trimble County. But neither of these lines would supply the additional EHV support needed in the Central Service Area.

Studies run with a 345 kV line from EK's Spurlock Station to Avon, 138 kV line (from Lexington) and 345 kV line (from Brown) ties to Avon revealed the need for this additional support in the Central Service Area.

Back-Up Power commitments are made at the time Pool units are committed. The installing Company is responsible for backing up the unit in an amount equal to 10 percent of its own forecasted Peak Load for the year the unit is to be operational. The other Companies are committed to supply Back-Up Power for the remainder of the Unit in proportion to their forecasted Peak Loads during that year. Hence, in 1981, Kentucky Utilities Company will be able to call on the other Pool members for 250 MW of Back-Up Power whenever Ghent 3 is out of service. This provision of the agreement augments Unit Power provisions in providing for installation of units larger than the individual companies could reasonably install outside the Pool.

Kentucky Utilities Company is forecasted to have only 83 MW or 2.8 percent reserve in 1983 with no capacity additions in that year. The installation of Ghent 4 is required to provide adequate reserves. With the unit Kentucky Utilities will have 580 MW or 19.7 percent reserves.

Kentucky Utilities Company, like all electrical utilities, is forced to plan for capacity to provide capability in excess of its forecasted peak load. This excess capacity provides a reserve to insure continued service to its customers in cases of generating unit outages either scheduled or unscheduled, generating unit derates, generating unit maintenance, to allow for forecast error and provide for vastly increased demands during periods of weather conditions extremely different from normal conditions used in forecasting loads. The methods of establishing adequate reserve margins are based on several considerations among which are: historical load data, equipment outage rates, largest unit to system size ratio, interconnections with other Companies and changing load patterns. At present, Kentucky Utilities has established a minimum of 17 percent for the reserve capacity margin considered necessary to insure against system wide "brown-outs" except for possible extreme contingencies. This figure is somewhat less than the 20 percent frequently mentioned as an average reserve requirement by the Federal Power Commission. However, because of its many interconnections with other systems including the Kentucky-Indiana Pool Companies, this reserve margin is considered adequate by the Company.

Table 1.2-7.

Kentucky-Indiana Pool
Load And Capacity-Summer 1981

Company	Peak Load	Diversity Power Receipts	Diversified Peak Load	Capacity Before Unit Addition	Reserve Before Unit Addition	
EK	858	-191	1049	1383	334 MW	31.8%
IPL	2571	157	2414	2528	114 MW	4.7%
KU	2504	29	2475	2529	54 MW	2.2%
PSI	4570	5	4565	5625	1060 MW	23.2%
Pool	10503	--	10503	12065	1562 MW	14.9%

Table 1.2-8.

Kentucky-Indiana Pool
Loads, Capacity And Reserves
1976-1981*

Year	Pool Peak Load	Pool Capacity At Time Of Peak Load	Pool Reserve At Time Of Peak	
1976	7225	9185	1960 MW	27.1%
1977	7840	9961	2121 MW	27.0%
1978	8500	11014	2514 MW	29.6%
1979	9213	11653	2440 MW	26.5%
1980	9993	12078	2085 MW	20.9%
1981	10503	12565	2062 MW	19.6%

* No capacity additions have been committed under the agreement past 1981.

1.2.6 Kentucky-Indiana Pool

Kentucky Utilities, as stated earlier, is a member of the Kentucky-Indiana Pool. Each year the members, having studied each Company's load and capacity situation as well as the Pool's, agree on capacity additions at least five years in the future. At the same time, commitments for Unit Power, Diversity Power and Back-Up Power are made for the year this new capacity is to be added. These commitments are firm contractual obligations. Presently commitments have been made for unit installations and power transactions through Unit Year 1981.

Unit Power is the vehicle in the pooling agreement whereby the members share the cost of providing adequate pool reserves. Usually the Company or Companies with the smallest forecasted reserves for the year in question will commit to provide the new unit capacity necessary to bring the Pool up to an agreed upon level of reserves. Each Company is then committed to carry its proportionate share of these reserves according to the provisions of the agreement. Power scheduled to be purchased and sold to accomplish this is termed Unit Power. The advantage of this system is that it allows for installation of larger more efficient units than the individual Companies could justify or provide back-up for were they not in the Pool. Kentucky Utilities Company is forecasted to have only 2.2 percent reserve in 1981 before any unit addition (Table 1.2-7). This is lower than any of the other Pool members hence Kentucky Utilities has agreed to install Ghent 3 as a Pool Unit to bring the Pool reserves up to the 19.6 percent reserves shown in Table 1.2-8. With the installation of the Unit Kentucky Utilities Company will have 18.6 percent reserves and will sell 87 MW of Unit Power (Table 1.2-5).

Diversity Power interchanges in the Kentucky-Indiana Pool are on a seasonal load period basis. The Companies which are Summer peaking purchase power from those who are Winter peaking during the summer load period and sell a like amount to those Companies in the winter load period. In doing so, the Companies all benefit to the extent their need to install capacity to meet peak loads is reduced in the amount of diversity power purchased. In 1981 Kentucky Utilities Company's Diversity Power transaction is 29 MW (Table 1.2-4).

Table 1.2-6.

Manufacturing Employment in Kentucky
1964-1974

Industry	1974		1964		% Change 1964-1974
	Number (000)	Percent of Total	Number (000)	Percent of Total	
Manufacturing	291.5	100.0	192.2	100.0	51.7
Nondurable goods	123.9	42.5	94.5	49.2	31.1
Food and kindred products	22.9	7.9	24.9	13.0	- 8.0
Distilled liquors, except brandy	6.0	2.1	6.6	3.4	- 9.1
Tobacco manufacturers	13.9	4.8	12.3	6.4	13.0
Cigarettes	11.1	3.8	8.4	4.4	32.4
Tobacco stemming and redrying	1.7	0.6	3.0	1.6	56.7
Textile mill products	7.2	2.5	2.8	1.5	157.1
Apparel and other textile products	29.0	9.9	23.6	12.3	22.9
Men's and boys' suits, coats	23.3	8.0	19.3	10.0	20.7
Paper and allied products	5.9	2.0	2.6	1.4	126.9
Printing and publishing	13.2	4.5	9.2	4.8	43.5
Chemicals and allied products	14.7	5.0	12.5	6.5	17.6
Industrial chemicals	5.9	2.0	5.2	2.7	13.5
Plastics and synthetics	5.1	1.7	4.9	2.6	4.1
Paints and allied products	2.0	0.7	1.5	0.8	33.3
Petroleum, rubber and plastic products	11.6	4.0	3.7	1.9	213.5
Leather and leather products	5.5	1.9	3.0	1.6	83.3
Durable goods	167.6	57.5	97.7	50.8	71.5
Lumber and wood products	10.2	3.5	9.0	4.7	13.3
Furniture and fixtures	6.4	2.2	6.2	3.2	3.2
Stone, clay and glass products	8.4	2.9	6.2	3.2	35.5
Primary metal industries	17.8	6.1	10.7	5.6	66.4
Blast furnace and basic steel products	8.9	3.1	8.4	4.4	6.0
Fabricated metal products	22.1	7.6	14.1	7.3	56.7
Machinery, except electrical	35.4	12.1	17.6	9.2	101.1
Electrical equipment and supplies	43.5	14.9	25.1	13.1	73.3
Transportation equipment	14.5	5.0	5.6	2.9	158.9
Other durable goods	9.3	3.2	3.3	1.7	181.8

Source: Kentucky Department for Human Resources, Bureau for Administration and Operations, Revised Published Nonagricultural Employment, 1964 and 1974.

Table 1.2-5.

Kentucky Utilities Co.
Load, Capacity And Reserves
1976-1983

Year	Summer* Peak Load	Total Capacity At Time of Summer Peak (Including Purchases)	Reserve	
1976	1665	2165	500	30.0%
1977	1807	2398	591	32.7%
1978	1961	2624	663	33.8%
1979	2127	2732	605	28.4%
1980	2308	2786	478	20.7%
1981	2504	2971	467	18.6%
1982	2717	3042	325	12.0%
1983	2948	3531	583	19.8%

* Winter Peak loads are slightly higher in 1982 & 1983. However, winter capacity rating on generating units are also higher to the extent that minimum reserve levels are during the summer period.

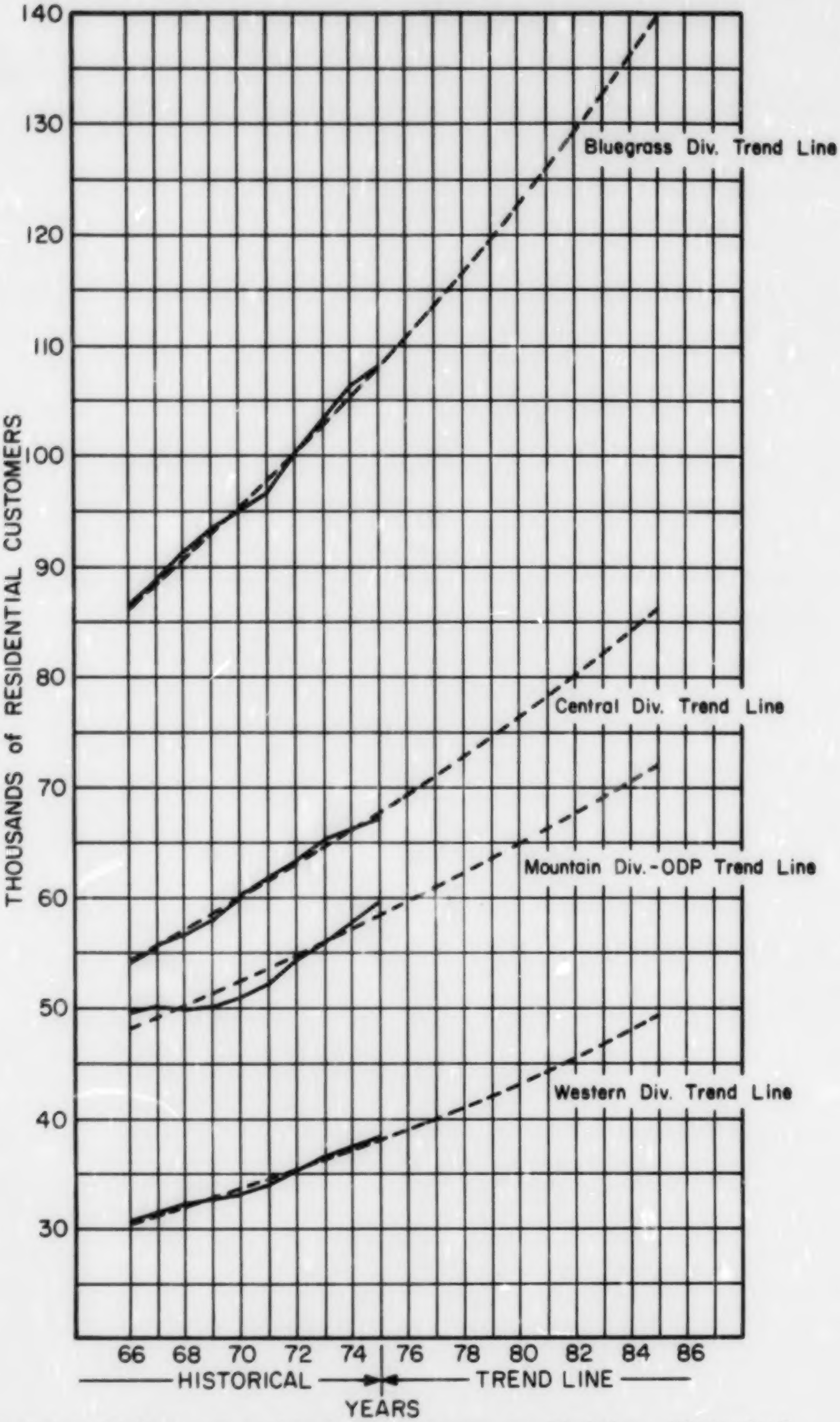


Figure 1.2-8. Numbers of residential customers by Division, Historical and Projected.

now served which were served until 1966 and that the trend line calculations include the data for the recession period 1974 and 1975.

A peak load demand of 2948 MW is forecasted for 1983 as shown on Table 1.2-5 which is 1151 MW above the winter peak of 1797 MW experienced in January 1977. It can be seen that the need for additional generating capacity will be a prime concern of Kentucky Utilities in the years to come.

1.2.5 Population and Industrial Increases

For years, Kentucky's population trends have been on the negative side. However, the trend now seems to be reversing. Kentucky's population as of 1 July 1974 was 3,357,000 according to the National Bureau of Census. This represents a 138,000 increase over the 1970 census figure. This percentage increase is greater than what Kentucky experienced during the whole decade of the 1950's, and is approaching the increase of 181,000 people experienced in the 1960's (Ford 1975).

Despite the downward trend of Kentucky's population prior to 1970, Kentucky Utilities Company's residential customers have increased at a steady rate. For the years 1966 through 1975, each of the Company's four divisions shows an annual levelized growth rate above 2 percent as illustrated on Figure 1.2-8. This historical growth establishes trend lines (also shown on Figure 1.2-8) indicating continuing growth through 1985. Kentucky Utilities Company estimates this annual growth rate to be 2.0 percent to 2.5 percent over the entire service area.

Closely allied with population growth is an even sharper increase in industry in Kentucky. Manufacturing employment increased 51.7 percent from 1964 to 1974, giving an indication of the increase in manufacturing industry in Kentucky (Table 1.2-6) (Kentucky Department for Human Resources 1975).

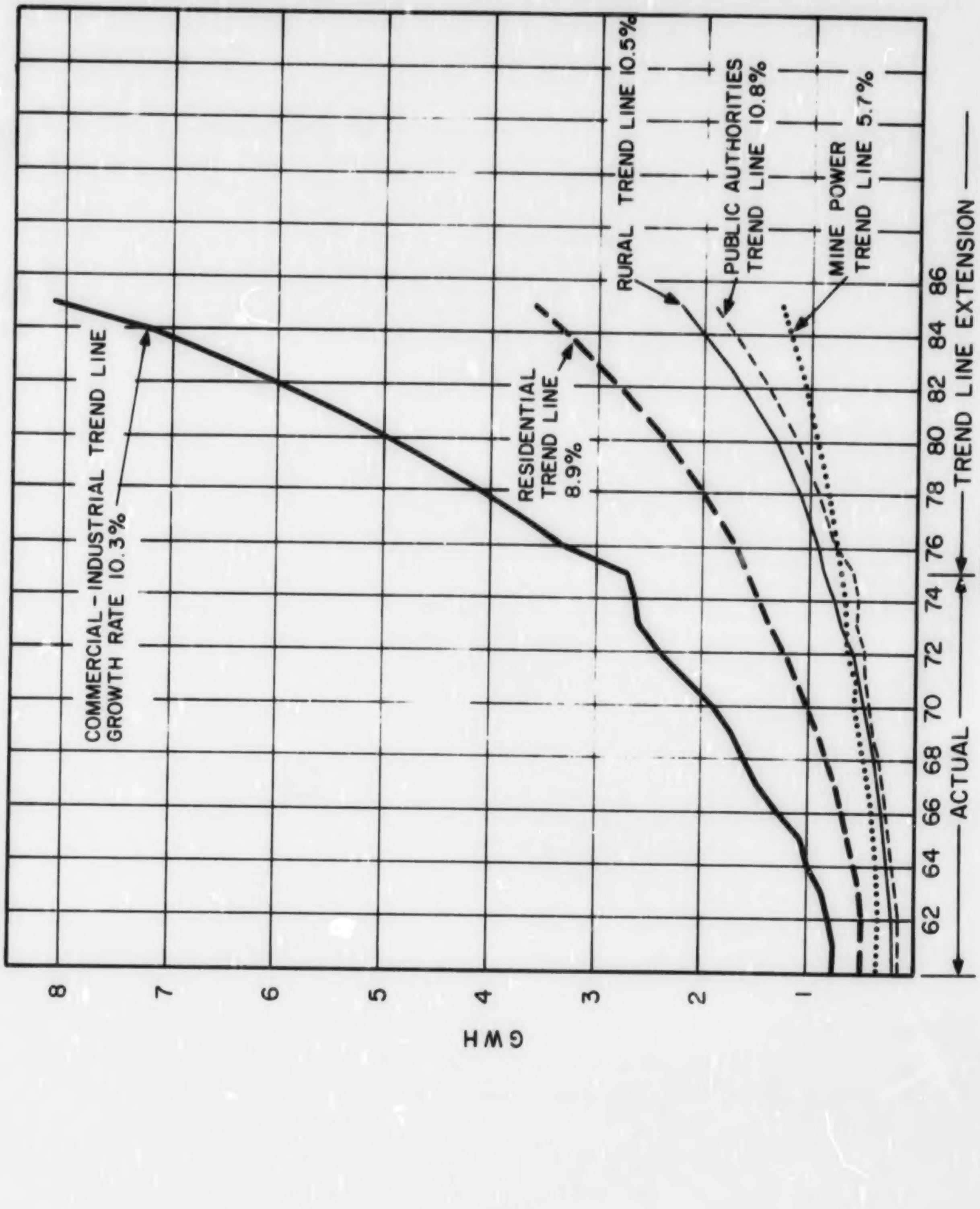


Figure 1.2-7. Kentucky Utilities Company-Electric use by customer classes.

times other than peak load conditions, a utility generally can cover the loss of a major unit from its own reserves. In 1975, it can be seen that the Company's purchases (3,237,576 MWH) approximates its sales to other utilities (3,055,903 MWH). In this way, the power generated (6,843,110 MWH) plus net power interchanged (159,763 MWH) approximates the sale to its own customers (7,184,546 MWH).

The input-output diagram, Figure 1.2-6, also illustrates the percent make-up of the system sales for 1975. As can be seen, the commercial and industrial sales make up the largest portion, 44.2 percent, and the combined rural and residential sales make up the second largest portion, 35.2 percent. Over the last ten years, the trend of system sales has been steadily upward with the combined portion of commercial, industrial and mine sales showing the largest increase. Rural and residential sales have demonstrated a steady and substantial growth (Figure 1.2-7).

1.2.4 Summary

In summary, Kentucky Utilities expects its system loads to continue growing at a substantial rate. While latest forecasts, like the national trend, are for a rate of growth less than forecasts made in the early 1970's, Kentucky Utilities continues to expect growth above the national average by reason of industrial expansion, increased residential use in the area of air conditioning and home heating and expanding coal mining productivity. As shown in Figure 1.2-7, the various segments of Kentucky Utilities kilowatt hour deliveries to its customers have steadily increased over the years 1960 through 1975 and are expected to continue increasing at a substantial rate. The historical growth curves plotted on Figure 1.2-7 have no adjustment factored in for the loads Kentucky Utilities Company served prior to 1966 and does not now serve as explained in Table 1.2-2. Despite this and the effects of conservation, economic recession and mild weather in the year 1974, residential sales show a growth rate of 8.1 percent 1960 through 1975 and industrial and commercial sales show an increase at a rate of 8.7 percent for the same time period. Rural sales show an even higher rate of 10 percent for the period. The trend line extension of the curves based on exponential curve fits of the historical data show 10.3 percent growth rate for commercial and industrial sales, 8.9 percent for residential and 10.5 percent for rural. Anticipated sales for future years are expected to be at growth rates at least as fast as these considering the fact that these trend lines have no adjustment for loads not

Table 1.2-4

Kentucky Utilities Company
Long-Term Purchases and Sales
Summer Seasonal Load Period

Year	Purchase (Excluding KIP) MW	Unit Power (KU Purchase) MW	KIP/KU Sale (MW)	KIP Diversity KU Purchase* (MW)
1965	242	0	0	0
1966	312	0	0	0
1967	314	0	0	0
1968	353	0	0	0
1969	385	0	0	0
1970	459	6	0	0
1971	187	7	0	12
1972	172	158	0	16
1973	213	235	0	21
1974	515	0	379	22
1975	497	0	233	26
Est.				
1976	471	0	51	31
1977	459	0	311	36
1978	349	24	0	37
1979	338	151	0	29
1980	528	15	0	29
1981	315	0	87	29
1982	328	0	0	0
1983	317	0	0	0

Source: Kentucky Utilities Company

* In accordance with Kentucky-Indiana Pool Agreement, Kentucky Utilities purchases Diversity Power in the summer and sells Diversity Power in the winter.

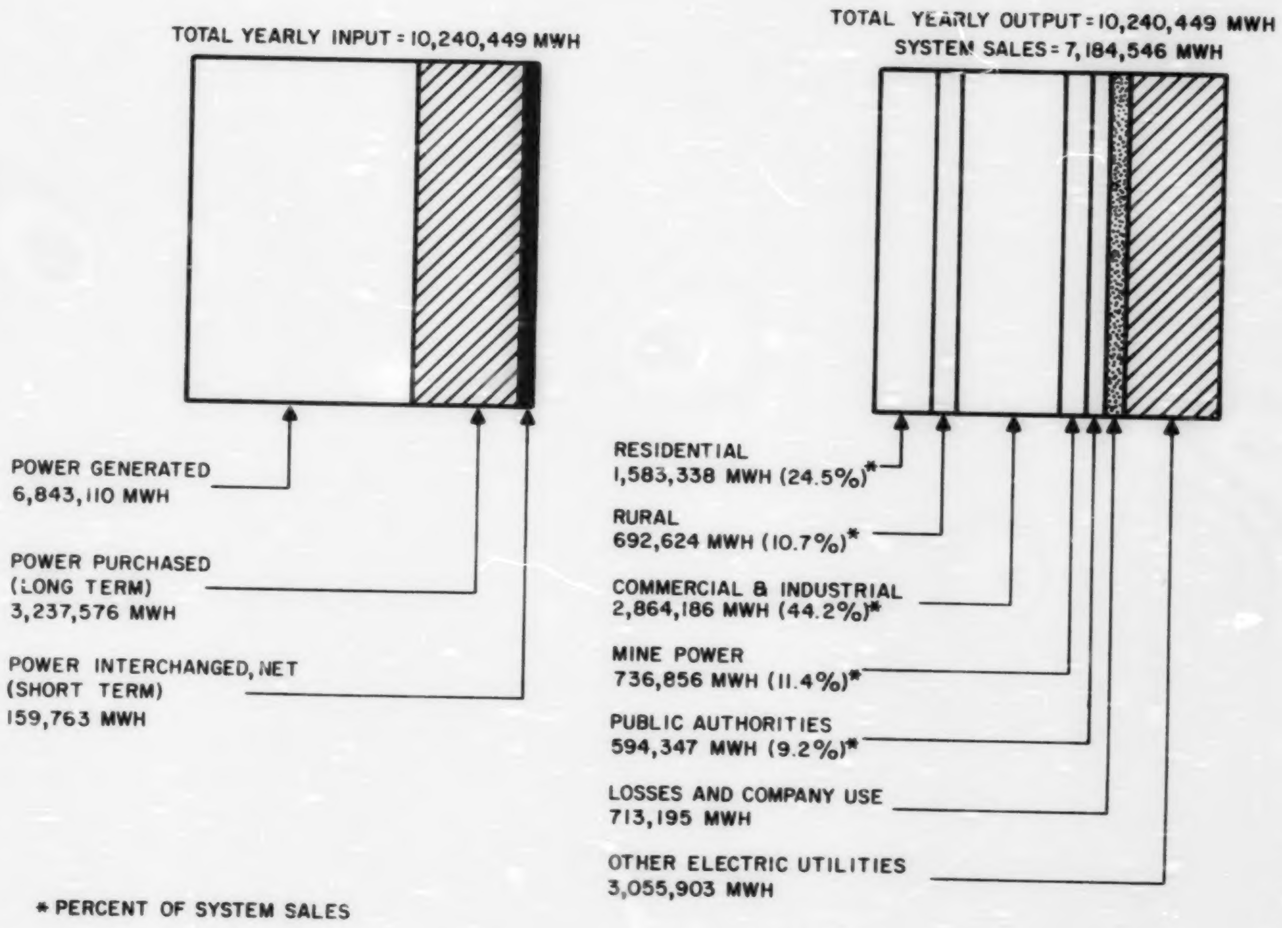


Figure 1.2-6. Input-output diagram, Kentucky Utilities, 1975.

Because of the increased number of all-electrical homes in Kentucky, the per capita use is expected to continue rise. In 1975, the average usage for an all-electric home per year was 18,900 kilowatt hours in the Kentucky Utilities service area. It is expected that by the 1990's, as all-electrical homes comprise a greater percentage of the total homes, the average usage per residential customer will approach the 18,900 kilowatt hour per year figure (Hittman Associates, Inc. 1972).

1.2.3 Generation, Sales and Purchases

It is possible to get further understanding of the complex system of sales and purchases through the input-output power diagram for Kentucky Utilities' calendar year 1975 (Figure 1.2-6). The white blocks in the diagram indicate power generated and power sold inside the Kentucky Utilities' system. The shaded blocks indicate power that was purchased from or sold to other utilities outside the Kentucky Utilities' system.

It should be noted that the quantity of purchases and sales from other utilities changes continually. Such transactions are either long-term or short-term contracts. Long-term contracts are those transactions which span a considerable period of time and are usually agreed upon months or years before the transactions take place (Table 1.2-4). In the case of KIP unit and diversity power, the commitments are on a Unit Year basis with the Unit Year beginning April 1st of a given year and ending March 31st of the following year. Also in KIP the Unit Year is divided into two seasonal load periods; the summer period comprised of the months of April through September, and the winter period comprised of the months of October through March. The data shown in Table 1.2-4 for KIP transactions is for the summer seasonal load period. Other long-term transactions are normally on a calendar year basis but may be only for specified months of the year. Short-term transactions are mainly dependent on the operating status of the system. Such power may be purchased to, among other things, cover short time unit outages, for reasons of economy or conservation of oil or natural gas fuel. In the case of a major unit outage which requires the purchase of additional power, the situation may become critical during peak load periods since all Pool members are operating at or near full load conditions. At such times, the available reserve margin of the Pool becomes all important. On the other hand at

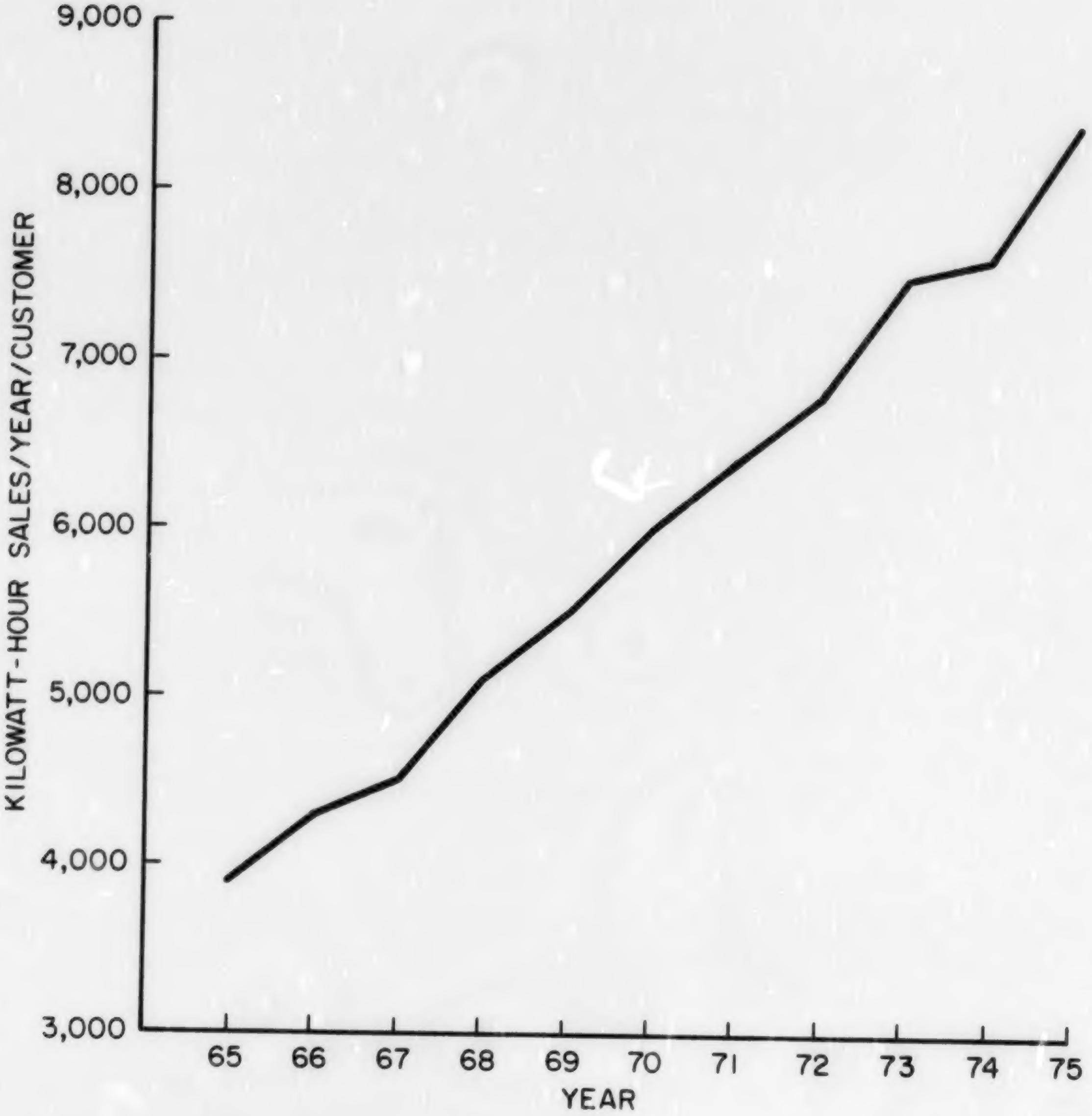


Figure 1.2-5. Per capita usage for urban and rural residential customers in the Kentucky Utilities service area.

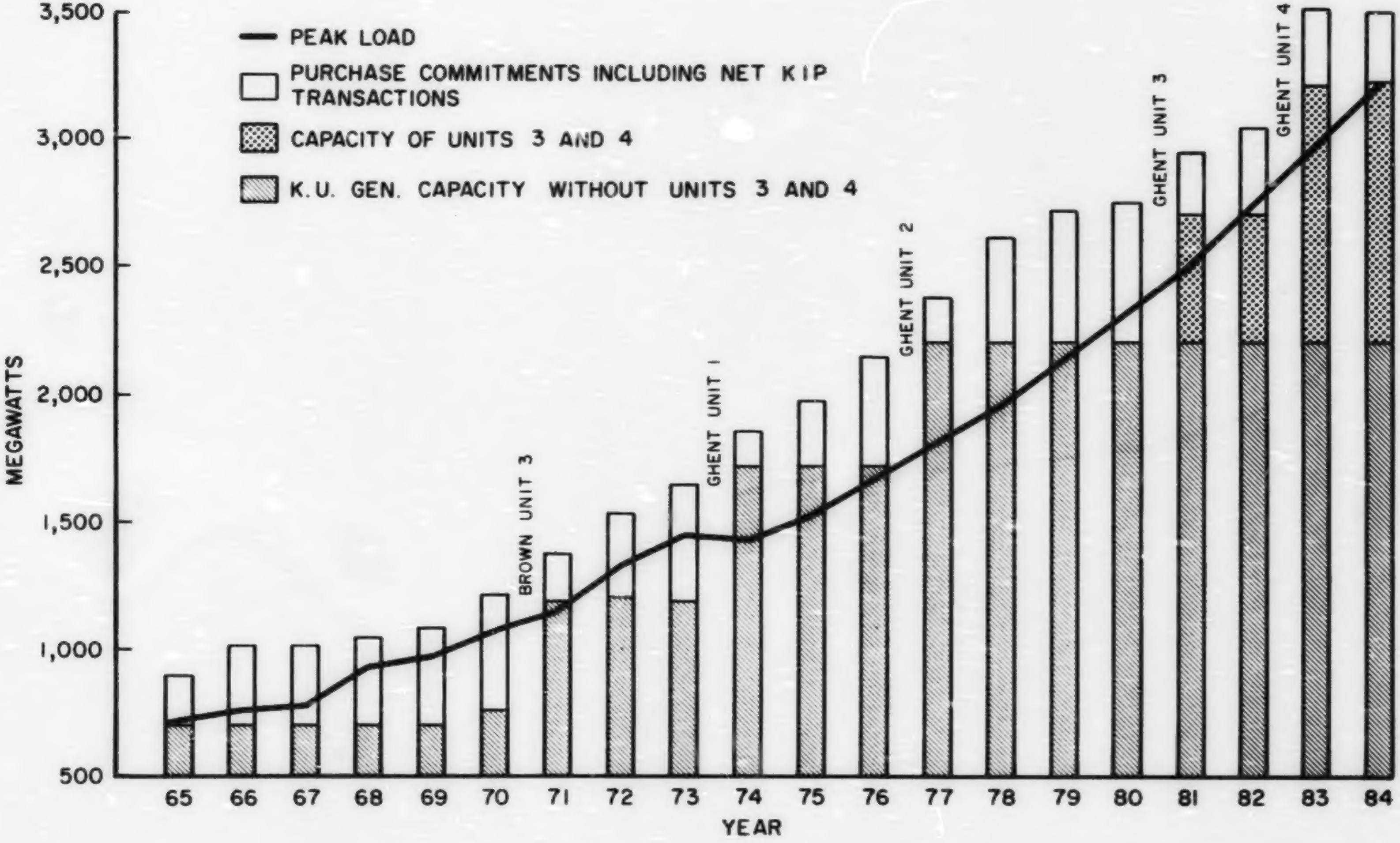


Figure 1.2-4. Capability, capacity and peak load. Historical 1965-1975, projected 1976-1984.

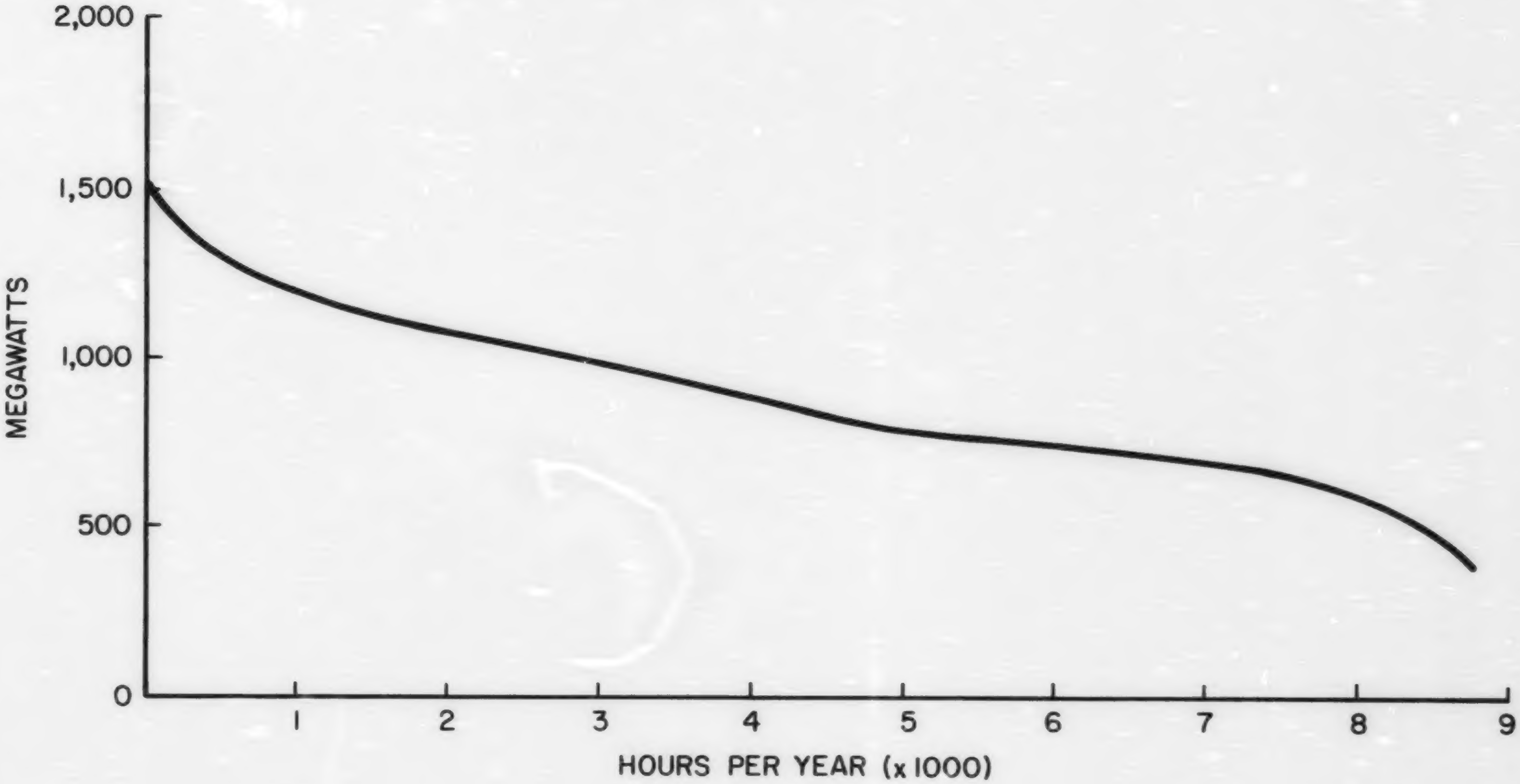


Figure 1.2-3. Kentucky Utilities total system load duration curve, 1975.

Table 1.2-3

Electrical Heating Trends in Kentucky

	1975	1974	1973	1972	1971	1970
Single Dwelling:						
Starts	3,683	3,859	5,044	5,246	4,012	3,529
Electrically heated	3,404	3,472	4,181	2,164	1,579	1,160
Percent	92.42%	89.97%	82.89%	41.25%	39.36%	32.87%
Apartments:						
Starts	1,088	1,409	1,900	2,578	2,396	2,427
Electrically heated	1,077	1,373	1,345	1,235	854	962
Percent	98.99%	97.44%	70.79%	47.91%	35.64%	39.64%
Single Dwelling and Apartments combined:						
Starts	4,771	5,268	6,944	7,824	6,408	5,956
Electrically heated	4,481	4,845	5,526	3,399	2,433	2,122
Percent	93.92%	91.97%	79.58%	43.44%	39.97%	35.63%
Mobile Homes:						
Total Net Additional	1,972	2,480	N/A	N/A	N/A	N/A
All-Electric	1,636	2,130	1,478*	607*	528*	263*
Percent	82.96%	85.89%	N/A	N/A	N/A	N/A

* Installations reported on Electric Heating Summary.

N/A - Not available.

Source: Kentucky Utilities Company

the system's demand may change to winter peaking. This change is mainly due to the restriction on gas connections to new customers because of the natural gas shortage in Kentucky. Table 1.2-3 indicates the increasing degree to which new construction has been relying upon electricity for winter heating in recent years.

Another method by which the load demand upon a utility company can be described is through a load duration curve. Figure 1.2-3 illustrates Kentucky Utilities' duration curve for 1975, giving the numbers of hours per year a particular demand in megawatts is reached or exceeded. The top of the curve shows a peak load demand of 1,536 MW for the year and the middle part of the curve shows a demand of over 900 MW during 50 percent of the year.

Peak load demand projections provide Kentucky Utilities with the means for planning construction of new generating units. By maintaining the capacity to cover peak loads during the heavy demand periods of the year, the Company also has the capacity to conduct periodic maintenance on its larger units during off-peak load periods in the spring and fall. Figure 1.2-4 demonstrates how Kentucky Utilities plans to meet its peak load demand through 1984 with Ghent's Units 3 and 4 going on-line in 1981 and 1983, respectively. It can be seen that through installation of units and power purchases, the Company will maintain adequate reserve margins.

1.2.2 Per Capita Demand

Per capita demand, as applied to residential usage, is defined as the average amount of electrical power in kilowatt hours consumed per customer. In the past ten years, this figure for urban and rural residential customers had demonstrated a continual rise (Figure 1.2-5). By the end of 1975, this figure reached a high of 8,406 kilowatt hours per capita per year (Kentucky Utilities Company 1976).

As of 1970, only 8.3 percent of the Kentucky housing units used electricity for heating, and 29.4 percent for water heating. These percentages are small when compared to housing units using natural gas for home heating, 58 percent, and for water heating, 51.2 percent (Hultman, unpublished).

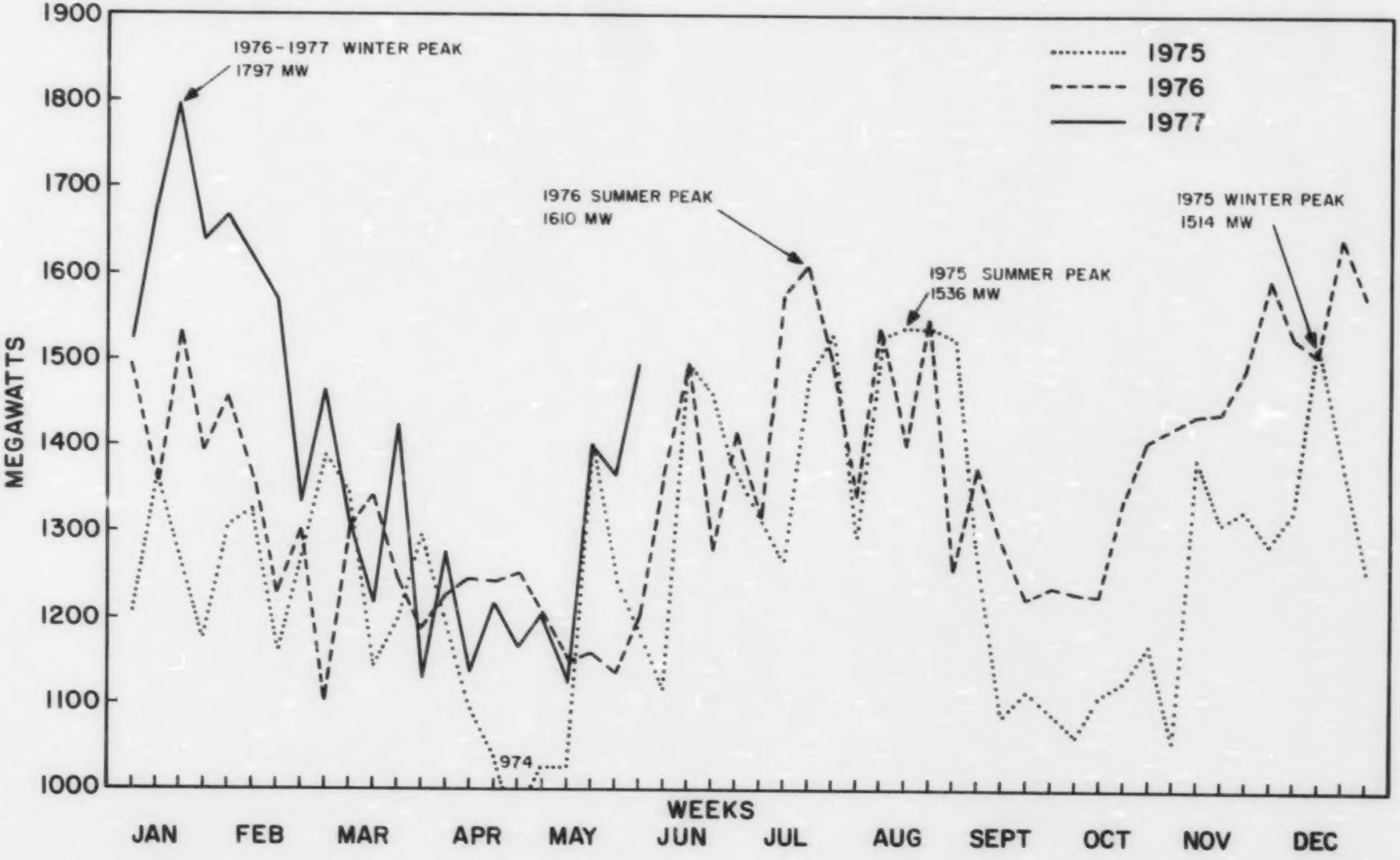


Figure 1.2-2. Weekly peak loads for Kentucky Utilities service area, 1975-1977.

Section 2 (2). The word "customer" means any person, firm, corporation, or body politic supplied service by any electric, gas, water or telephone utility.

Section 5 (2). A customer who complied with the regulations of the Commission should not be denied service for failure to comply with the rules of the utility which have not been made effective in the manner prescribed by the Commission.

Kentucky Utilities Company therefore has to be concerned with both the present electrical demand as well as future electrical demands. Since the average time period for planning and construction of a fossil fuel steam electric generating unit is five years, long-term planning, including prediction of future needs, is necessary. The following factors all play a role in the estimation of future demand and therefore future expansion plans in the Kentucky Utilities system:

- Peak load demand
- Per capita demand
- Generation and sales
- Population and industrial increases
- Reserve margin
- Kentucky-Indiana Pool obligations

1.2.1 Peak Load Demand

Utility companies normally experience a yearly or semi-yearly peak in electrical usage by their customers. This peak in usage is called the "peak load demand" and is defined as the largest hourly kilowatt demand delivered anytime during a one-year period.

Depending upon the meteorological region, this can be a summer peak or a winter peak. A summer peak usually results from air conditioning use during the hottest part of the summer, whereas a winter peak results largely from electrical heating during the coldest part of the winter.

Kentucky Utilities is presently in a transition period with the summer and winter peaks essentially equal (Figure 1.2-2). However, by 1982, the Company predicts that power, these measures have already evidenced their greatest reduction. On Kentucky Utilities Company's system this appears to have amounted to about one year load growth. This is reflected in Figure 1.2-1. Any relaxation in conservation efforts by consumers will result in higher than forecasted peak demands.

In 1975, despite continuing economic sluggishness, the system demand increased 7.2 percent over 1974. There is little question that as the economy returns to a more normal state, a rate of growth higher than that experienced in 1975 can be expected. On the other hand, considering the continuing effect of conservation measures, and some question that the economy will, in the next half decade, return to a pre-1973 state, Kentucky Utilities Company feels that a growth rate substantially less than the historical trend is to be expected. On this basis and as shown on Figure 1.2-1, Kentucky Utilities is using the peak established in summer 1975 as a base (reflecting as noted above a one year loss of load) and forecasting load growth from this base at a rate of 8.5 percent per year for summer peaks.

The summer peak load experienced by Kentucky Utilities for 1976 was 1610 MW.* This figure is 3.3 percent lower than the 1665 MW summer peak forecasted for this year (see Figure 1.2-1). Kentucky Utilities has completed an investigation of the factors influencing this peak load to determine how representative those factors would be to periods of peak load in the future. It was found that since the 1976 summer peak occurred on a Friday (historically summer peaks occur on a Tuesday or Wednesday) with reduced coal mine load requirements due to a miners' holiday, the peak was somewhat lower than forecasted. Had weather conditions contributing to the summer peak load occurred on a Tuesday or Wednesday during a general load buildup after the weekend and during full load demand from the coal mining industry, a peak more closely approximating the 1665 MW forecasted would probably have been reached. It is expected that future summer peak loads will more closely approximate the forecasted curve in Figure 1.2-1.

Kentucky Utilities provides electrical power to its customers under the regulations and statutes of the Kentucky Public Service Commission Law. Under this law, the Company is required to provide electricity to any customer, as specified in Title 807 KAR 2:010 as follows:

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* The winter peak load experienced on 18 January 1977 was 1797 MW.

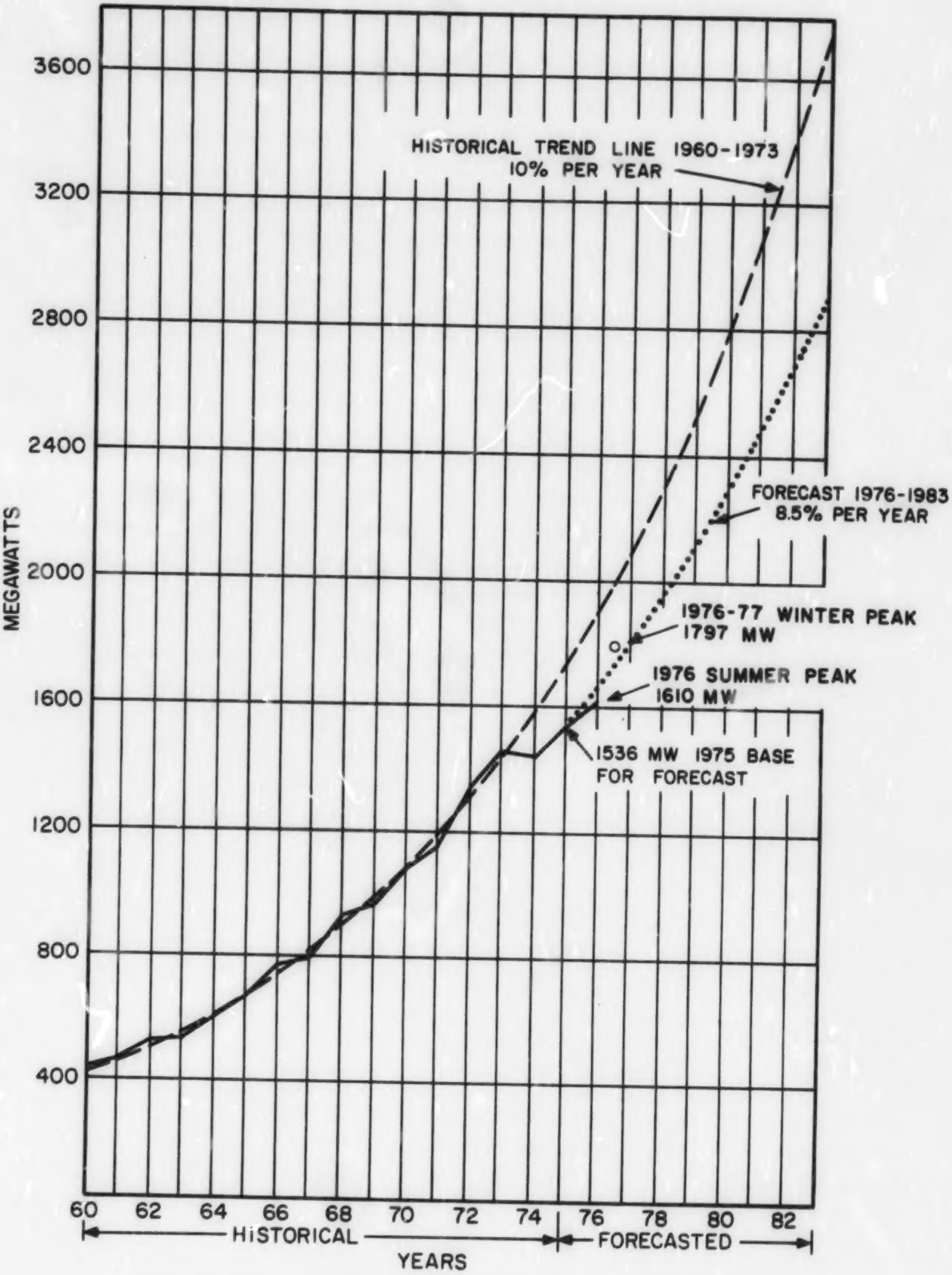


Figure 1.2-1. Kentucky Utilities Company summer peak loads-historical and forecasted.

Table 1.2-2.

Kentucky Utilities Summer Peak Loads
And Percent Growth
1960-1976

Year	Actual Peak Load (MW)	Adjustment* For Loss Of Load	Adjusted Peak Load	Increase From Previous Year (%)
1960	489	63	426	--
1961	522	61	461	8.2
1962	584	66	518	12.4
1963	583	49	534	3.1
1964	665	54	611	14.4
1965	727	61	666	9.0
1966	781	14	767	15.2
1967	789	--	789	2.9
1968	937	--	937	18.8
1969	979	--	979	4.5
1970	1082	--	1082	10.5
1971	1150	--	1150	6.3
1972	1348	--	1348	17.2
1973	1458	--	1458	8.2
1974	1433	--	1433	-1.7
1975	1536	--	1536	7.2
1976	1610	--	1610	4.8
		LEVELIZED - ANNUAL RATE OF GROWTH		8.7

* During the years 1960 through 1966 Kentucky Utilities served the cities of Princeton, Fulton, Paducah and Glasgow, Kentucky, as well as two electric cooperatives (now members of Big Rivers Electric Corp.). These cities, since 1966, have been served by TVA and the electric cooperatives have received their power from Big Rivers. In order to compare peak loads before 1967 with those after, the load of these cities and co-ops are removed from peak load data prior to 1967. In this manner, these loads and their subsequent growth are not a factor in Kentucky Utilities growth trends.

Table 1.2-1.

Power Utility Sales, Output, and Capacity*

Year	Total Sales (10^9 Kw-h)	Total Output (10^9 Kw-h)	Installed Capacity (MW)	Peak Load (MW)	Installed Peak Load Ratio
1960	681	765	175,000	133,000	1.31
1965	950	1060	216,000	175,000	1.24
1968	1198	1327	279,000	238,000	1.17
1969	1302	1446	300,000	258,000	1.16
1970	1386	1540	325,000	275,000	1.19
1975 (est)	2013	2226	448,000	390,000	1.25
1980 (est)	2901	3200	681,000	544,000	1.24

* United States Total.

Source: Electrical World Magazine, McGraw-Hill, September 15, 1970.

1.2 THE NEED FOR ADDITIONAL GENERATING CAPACITY

Over the past 50 years, the demand for electrical power in the United States has doubled each decade. This corresponds to an annual average increment in power generation capacity of 7.15 percent per year (Table 1.2-1). It is expected that this growth rate will continue at a similar rate through at least the end of the century. Increased usage of personal comfort and convenience items in the home, the expansion of manufacturing and production capacities, and other factors have been, and will continue to be, major causative factors for this growth in power demand (Hittman Associates, Inc. 1972).

In order to trace Kentucky Utilities Company growth in peak demand through the decade of the 1960's and so far in the 1970's, several city and Rural Electric Coop Corporation loads served by Kentucky Utilities prior to 1966 and not presently served, along with the future growth of these loads, have to be taken into account. Between 1960 and 1966 the cities of Princeton, Fulton, Paducah and Glasgow, Kentucky theretofore served by Kentucky Utilities Company began to take service from TVA. In addition, in 1966 three rural cooperatives (two of which Kentucky Utilities had supplied in the past) formed Big Rivers Electric Corporation, installing generation to serve their own loads. The adjustments shown on Table 1.2-2 serve to remove these loads from the system peak load in the years they were being served so that growth patterns spanning times when these loads were being served and since may be made.

The adjusted figures (Table 1.2-2) show a variable year by year growth in peak load from 1960 until the recession year of 1974 with an overall compound growth rate of 8.7 percent. The trend line developed using a least squares exponential curve fit for this period is for 10 percent per year annual growth. This trend line is shown on figure 1.2-1. During the period 1967 through 1973 when no adjustment for loss of load is required the compound growth rate was 10.8 percent.

During the year 1974, attributable to the state of the economy, energy conservation me sures and weather conditions, the peak demand decreased 1.7 percent. While there is every indication conservation measures will continue to affect the demand for electric

20 percent of any capacity at the Joppa plant not required to meet Electric Energy's contractual obligations to ERDA. Likewise, Kentucky Utilities Company owns 2.5 percent of the 2250 MW generating capacity of the Ohio Valley Electric Company under contract to supply electric power to ERDA's plant near Portsmouth, Ohio and is entitled to receive 2.5 percent of the capacity not required to meet OVEC's contractual obligations to ERDA.

A system operation center is maintained at Dix Dam near Burgin, Kentucky from which the operation of all generating and transmission facilities are controlled. At this center a dispatch computer determines and controls at all times the operation of the Company's generating units to meet the system load in the most economical manner. The functions of this computer include unit commitment which is a process that determines the most economical operating schedule for generating units to meet predicted system load each day and economic dispatch which is a process to determine the most economical load assignments for each generating unit. In addition, the computer is used to evaluate the options of sale or purchase of power at any time with each of the interconnected neighboring Companies.

The most efficient and economical units and therefore the most utilized, are Ghent Unit 1, Green River Units 1, 2, 3 and 4, and Brown Units 1, 2 and 3. Other units at Pineville, Tyrone and Haefling are less efficient and more expensive to run and are used mainly as peaking units during peak load periods. The range of fuel costs as of January 1976 was from 5.96 mills/kwh for the least expensive base load unit to 36.152 mills/kwh for the most expensive peaking unit.

Kentucky Utilities Company has interconnection agreements with eleven other companies for short-term and long-term power transactions. Three of these companies (Indianapolis Power and Light Company, Public Service of Indiana and East Kentucky Power Cooperative) joined with Kentucky Utilities in 1971 to form the Kentucky-Indiana Pool (KIP). The objectives of KIP are to coordinate installation and operation of the four Companies' generation and transmission systems to achieve maximum operating economy.

Table 1.1-2.
Kentucky Utilities Power Station Descriptions

Station	County	Unit	Nameplate *	Type	Fuel
Brown	Mercer	1	100 MW	Steam	Coal
		2	157 MW	Steam	Coal
		3	410 MW	Steam	Coal
		Total	667 MW		
Ghent	Carroll	1	511 MW	Steam	Coal
		2	511 MW**	Steam	Coal
		Total	1022 MW		
Green River	Muhlenberg	1	33 MW	Steam	Coal
		2	33 MW	Steam	Coal
		3	66 MW	Steam	Coal
		4	100 MW	Steam	Coal
		Total	232 MW		
Haefling	Fayette	1	21 MW	Gas Turbine	Gas/Oil
		2	21 MW	Gas Turbine	Gas/Oil
		3	21 MW	Gas Turbine	Gas/Oil
		Total	63 MW		
Pineville	Bell	3	33 MW	Steam	Coal
Tyrone	Woodford	1	25 MW	Steam	Oil
		2	25 MW	Steam	Oil
		3	66 MW	Steam	Coal
		Total	116 MW		
Dix Dam	Mercer	1	9.3 MW	Hydro	-
		2	9.3 MW	Hydro	-
		3	9.3 MW	Hydro	-
		Total	27.9 MW		
Lock 7	Mercer	1	0.7 MW	Hydro	-
		2	0.7 MW	Hydro	-
		3	0.7 MW	Hydro	-
		Total	2.1 MW		

Source: Kentucky Utilities Company

* Nameplate ratings are the manufacturer's specified ratings and may differ from actual ratings given in the text.

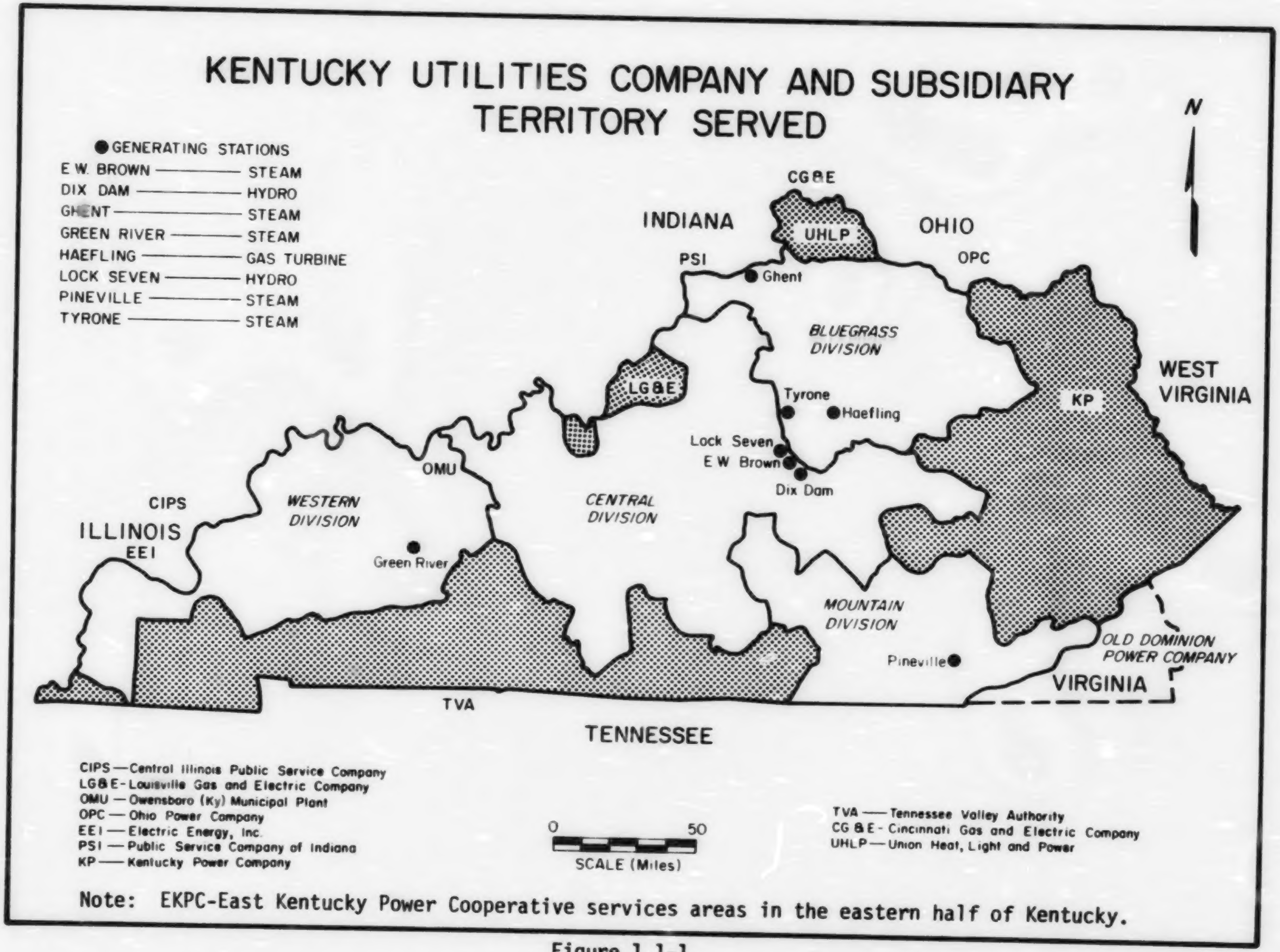
** Scheduled for completion in 1977.

Table 1.1-1.

Kentucky Utilities Company Highlights
1973-75

	1973	1974	1975	Percent Increase 1973-75
Operating Revenues (000's)	$120,439	$165,076	$221,085	83.6
Net Income (000's)	19,185	13,260	24,257	26.4
Earnings per average share of common stock	$2.80	$1.63	$3.18	13.6
Dividends per share of common stock	1.74	1.74	1.75	.9
Construction expenditures (000's)	$ 57,072	$ 57,133	$ 84,283	47.6
Gross utility plant (000's)	576,559	629,783	709,370	23.0
Sale of securities-- Long-term debt and capital stock (000's)	14,513	48,000	54,213	73.5
Kilowatt hour sales (000's)	7,132,375	9,008,514	9,527,254	33.6
System peak demand in KW	1,458,000	1,433,000	1,536,000	5.3
Average annual residential use in KWh	7,503	7,633	8,406	12.0
Cost of fuel used in generation (000's)	21,516	46,059	58,093	170.0
Number of employees, December 31	1,614	1,634	1,627	.8
Number of customers, December 31	307,404	315,521	322,076	4.8

Source: Kentucky Utilities Company



Note: EKPC-East Kentucky Power Cooperative services areas in the eastern half of Kentucky.

Figure 1.1-1.

1.1 COMPANY DESCRIPTION

Kentucky Utilities Company is an investor-owned company listed on the New York Stock Exchange. It was chartered by the Commonwealth of Kentucky on August 17, 1912 and has provided electricity for the people of Kentucky since December 2, 1912.

Kentucky Utilities' service area encompasses a major portion of Kentucky and is made up of four major divisions: Western, Central, Bluegrass and Mountain. The area of these four divisions lies in 78 of the 120 Kentucky counties. Old Dominion Power Company, a subsidiary of Kentucky Utilities Company, is located to the east of the Mountain Division in five counties of Virginia. The home office for the service area is located in Lexington, Kentucky, with divisional and service offices located throughout the state (Figure 1.1-1).

The operational highlights of Kentucky Utilities Company for the calendar years 1973, 1974 and 1975 appear in Table 1.1-1. Although the percent increase column represents only a two year period, it gives an idea of the Company's growth through a period of economic recession.

Within the Kentucky Utilities system, there are eight electric generating stations with a total net generating capacity of 1714 MW in the summer months and 1742 MW during the winter months. The generating stations consist of five coal fired steam electric generating stations, two hydroelectric generating stations and one combustion turbine generating station (Table 1.1-2).

Aside from this installed capacity, Kentucky Utilities has available, by contract, the capacity in excess of Owensboro Municipal Utilities needs of their Elmer Smith Units 1 and 2 which have a total net summer capacity of 409 MW and 417 MW net winter capacity. Kentucky Utilities also owns 20 percent of the stock in Electric Energy, Inc. with a 1000 MW capacity plant located at Joppa, Illinois under contract to supply electric power to Energy Research and Development Administration's plant near Paducah, Kentucky. By its stock ownership, Kentucky Utilities is entitled to

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FOREWARD

Kentucky Utilities Company proposes to construct two additional coal fired steam electric generating units on an existing site located near Ghent, Kentucky. Each of the units will have a gross rating of about 550 MW with an expected net rating of about 500 MW. At present, Unit 1 at the site is operational and Unit 2 (500 MW estimated net) is under construction to be in operation in 1977. When completed, this station will have four units for a total net generating capacity of about 2000 MW. The construction will also include a 345 kV transmission line which will connect the Ghent Station to a load center about five miles west of Frankfort, Kentucky.

Pursuant to regulations implementing the National Environmental Policy Act of 1969 (NEPA), this statement on the construction of the Ghent Station Units 3 and 4 was prepared utilizing a third party consultant approval procedure. Under this procedure, the applicant, Kentucky Utilities Company, nominated Geo-Marine, Inc. as the contractor. Geo-Marine was then reviewed and approved by the Environmental Protection Agency, Region IV, for objectivity and qualification. An objectivity and qualification statement was then circulated to interested parties for comment and after the comments were reviewed, final approval of Geo-Marine was made by EPA, Region IV. All work completed by Geo-Marine was reviewed by EPA before final publication.

In this report, consideration was given to all matters required by the guidelines published by EPA, Region IV for preparation of environmental statements. The material was selected and arranged in a manner which was considered most appropriate for discussion of the overall impact of this project.

Description of the proposed project is outlined in Section 1 and includes identification of the applicant, objectives of the proposed project, and finally, the project scope. Section 2 gives details on the environment without the proposed action and includes descriptions of the natural environment and the man-made environment. Description of the proposed construction is discussed in Section 3, followed by alternatives to the proposed action in Section 4 and environmental effects of the proposed action in Section 5. Section 6 includes unavoidable adverse impacts and suggested mitigative measures. Section 7 will be comprised of comments from Federal or State agencies and the public.

A draft version of the NPDES Permit is present in Section 8. This is EPA's proposed regulatory action. Changes in the permit effluent limitations and permit conditions may result following the EIS review process and further public input on the proposed permit issuance. Also presented in Section 8 is the Corps of Engineers' Draft Public Notice which describes the proposed construction at the Ghent Station that requires a Section 10 and Section 404 Construction Permit (up to and near high water elevation). It is expected that the Draft Public Notice will be circulated for a 30-day public comment period within several days following the official filing date of the Draft EIS with the CEQ.

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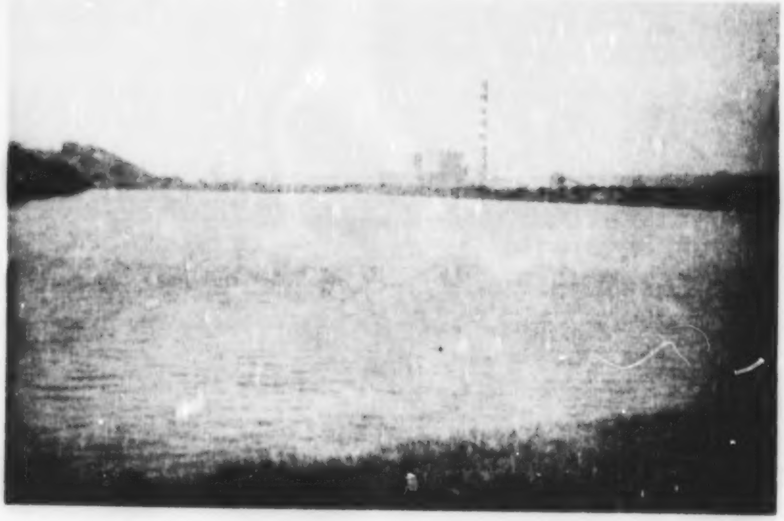

SECTION 1.0

DESCRIPTION OF THE PROPOSED PROJECT

Table 2.2-11

CROPS HARVESTED: 1969

Counties:		Carroll	Gallatin	Switzerland
Field corn for all purposes	farms	90	87	308
For grain	farms	82	68	281
	acres	1,593	694	3,875
	bushels	120,880	46,227	324,160
Cut for silage, green or dry fodder, or hogged or grazed	farms	20	33	50
	acres	221	395	853
Sorghums for all purposes except syrup	farms	13	18	19
For grain or seed	farms	2	-	4
	acres	2	-	4
	bushels	160	-	300
Cut for silage, dry forage or hay, or hogged or grazed	farms	13	18	15
	acres	71	52	63
Wheat for grain	farms	9	2	110
	acres	103	22	1,136
	bushels	3,065	560	35,347
Other small grains for grain	farms	4	3	60
	acres	72	15	500
Soybeans for beans	farms	7	1	104
	acres	72	35	2,820
	bushels	2,525	875	82,613
Hay, excluding sorghum hay	farms	234	186	476
	acres	5,959	3,477	9,317
	tons	11,404	5,655	16,570
Cotton	farms	-	-	-
	acres	-	-	-
	bales	-	-	-
Peanuts for nuts	farms	-	-	-
	acres	-	-	-
	pounds	-	-	-
Tobacco	farms	403	302	675
	acres	1,246	753	1,001
	pounds	3,050,546	1,782,709	2,588,649
Irish potatoes and sweetpotatoes	farms	25	22	63
	acres	83	33	96
Vegetables, sweet corn, or melons for sale	farms	2	2	2
	acres	12	1	1
Berries for sale	farms	1	2	2
	acres	(Z)	1	(Z)
Land in orchards (see text)	farms	4	1	3
	acres	16	(D)*	5
Other crops	farms	9	16	17
	acres	51	429	181
Greenhouse products under glass or other protection	farms	2	-	-
	sq. ft.	18	-	-

* (D) = data withheld to avoid disclosure of information on individual reporting units.

Source: U.S. Department of Commerce 1974.

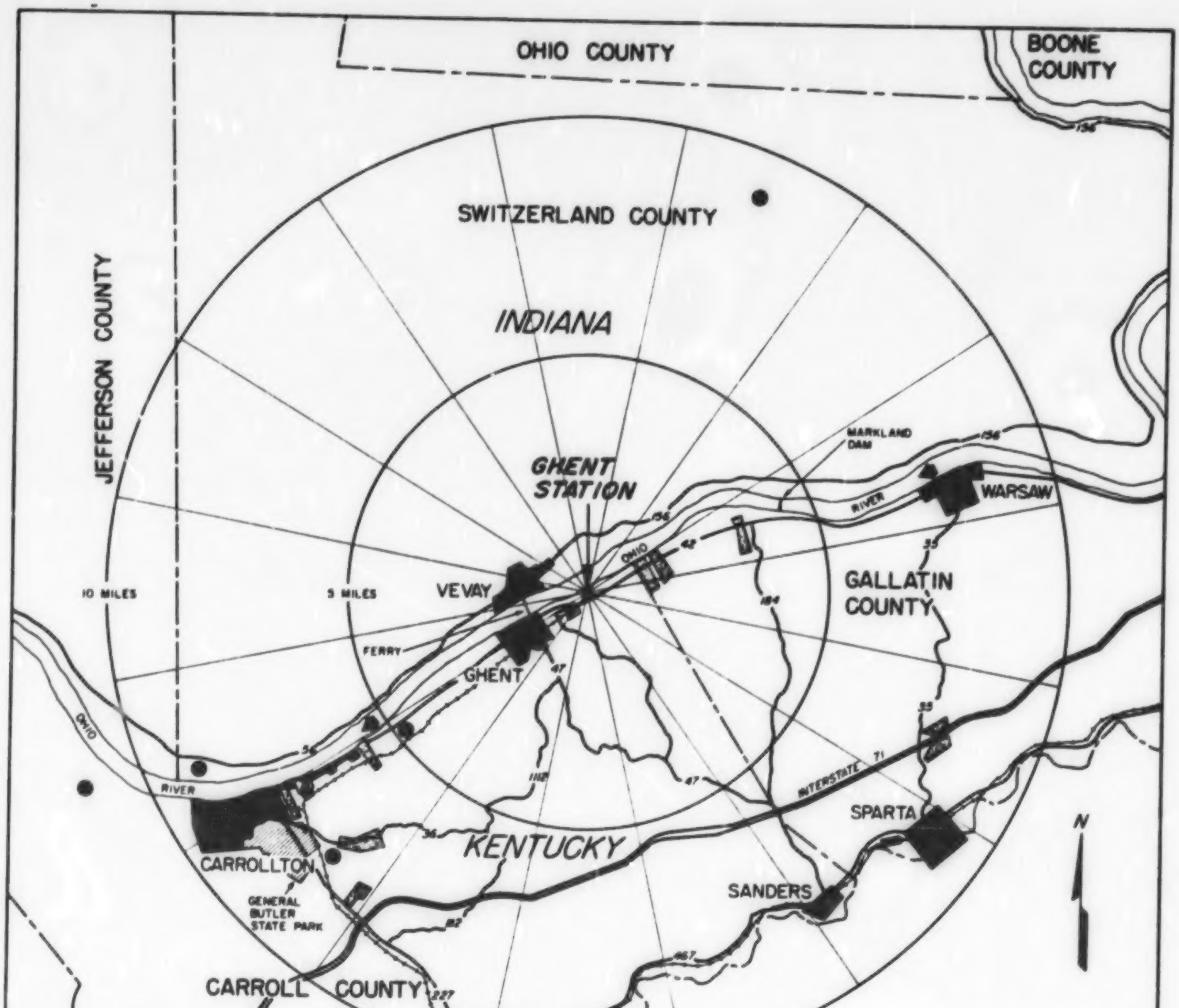

Figure 2.2-4. Present and future land use of study area.

Table 2.2-12

WHOLESALE TRADE: 1972

County and city	Total						Merchant wholesalers		Other operating types	
	Estab-lish-ments	Sales ($1,000)	Inventories, end of year 1972 ($1,000)	Payroll, entire year ($1,000)	Payroll first quarter 1972 ($1,000)	Paid employees for week including March 12	Estab-lish-ments	Sales ($1,000)	Estab-lish-ments	Sales ($1,000)
Carroll County	25	25,329	1,672	923	249	108	13	4,567	12	20,762
Gallatin County	9	3,347	128	167	41	35	7	(D)	2	(D)
Switzerland County	7	2,635	152	169	41	28	5	(D)	2	(D)

* (D) = data withheld to avoid disclosure of information on individual reporting units.

Source: U. S. Department of Commerce, Bureau of the Census, Census of Wholesale 1972 Area Series, Kentucky and Indiana

RETAIL TRADE: 1972

County and city	Total									Kind-of-business group			
	All establishments				Establishments with payroll					Building materials, hardware, garden supply, mobile home dealers (all establishments)		General mdse. group stores (all establish-ments)	
	Number	Sales ($1,000)	Sole proprie-torships	Partner-ships	Number	Sales ($1,000)	Payroll, entire year ($1,000)	Payroll first quarter 1972 ($1,000)	Paid employees for week including March 12	Number	Sales ($1,000)	Number	Sales ($1,000)
Carroll County	113	14,469	55	15	77	13,214	1,395	317	306	6	1,298	6	756
Carrollton	90	12,999	40	14	64	12,071	1,291	288	276	4	(D)*	5	(D)
Remainder of county	23	1,470	15	1	13	1,143	104	29	30	2	(D)	1	(D)
Gallatin County	38	5,042	18	5	30	4,867	424	107	123	4	461	3	(D)
Switzerland County	57	5,632	28	2	37	4,873	324	81	106	3	223	5	364

*(D) = data withheld to avoid disclosure of information on individual reporting units.

Source: U. S. Department of Commerce, Bureau of the Census, Census of Retail 1972 Area Series, Kentucky and Indiana

Table 2.2-13

NUMBER OF INDUSTRIES: 1970

County and city	All establishments				Establishments with payroll				
			Operated by unincorporated businesses						
	Number	Receipts ($1,000)	Sole proprie-torships	Partnerships	Number	Receipts ($1,000)	Payroll, entire year ($1,000)	Payroll first quarter 1972 ($1,000)	Paid employees for week including March 12
Carroll County	54	1,037	38	6	24	764	170	41	42
Carrollton	45	921	32	5	20	677	157	38	39
Remainder of county	9	116	6	1	4	87	13	3	3
Gallatin County	25	548	17	2	10	409	64	14	14
Switzerland County	33	421	22	1	10	235	47	13	11

Source: U. S. Department, Bureau of the Census, 1970 Selected Service Industries-Area Statistics, Kentucky and Indiana

2.2.2.2 Future Land Use

Future land use is closely related to population and economic growth. As population increases occur, there will be a greater demand for land for residential, commercial and service activities. Population increase of 58 percent by the year 2020 is expected in Carroll County. Trends for the three counties indicate continued rapid industrial growth for Carroll County and moderate to slow growth for Gallatin and Switzerland Counties. Although agriculture is decreasing for these counties, it is unlikely that it will be replaced as the major land use.

Gallatin County is expected to increase its population by 169 percent, whereas Switzerland County's population is expected to decrease by 8 percent by the year 2020. Although Gallatin County is expected to grow at an accelerated rate, industrial growth is not expected to compare. It is expected, however, that a large part of the work force will have to find work outside the County (North Kentucky Area Development District 1976). Proposed industrial sites suggested by the Kentucky Department of Commerce are shown in Figure 2.2-4. These sites are within 10 miles of the Ghent power plant and are located in Kentucky. The sites range from 10 acres to approximately 400 acres and total 1,584 acres.

Switzerland County is expected to show moderate industrial growth in the future. However, industrial growth predictions are still difficult to make due to the uncertainty of proposed industrial sitings and the unknown commercial effect of the soon to be completed bridge over the Ohio River at Markland Dam.

2.2.3 Transportation

The following information presented for this section is obtained from Watkins and Associates, Inc. 1974 Comprehensive Plan for Carroll County, Kentucky, p. 69-88, prepared for the Carroll County Planning Commission. Although the above report is for Carroll County, it also applies to Gallatin County and is indirectly applicable to Switzerland County, Indiana. Switzerland County is accessible to Carroll County by a ferry some miles downstream from the power plant.

2.2.3.1 Present Transportation

2.2.3.1.1 Railroads

Carroll County has very good rail transportation through the Carrollton Railroad and Louisville and Nashville Railroad.

The L&N Railroad is one of the largest lines in the county. It directly serves the mid-south from the Ohio River to the Gulf of Mexico. It's main line from Louisville to Cincinnati passes through Worthville and Sanders, and is along Carroll County's southern boundary. Presently, there are three fast freight trains per day each way that stop at Worthville where connections are made with Carrollton and Ghent over the Carrollton Railroad.

The Carrollton Railroad runs from Ghent and Carrollton to Worthville once a day, 6 days a week. It connects the industries in Carrollton and those along the Ohio River between Carrollton and the Gallatin County line with the L&N main line at Worthville. The Carrollton line is a wholely-owned subsidiary of the L&N Railroad carrying 1.5 million tons of freight last year. Only carload freight service is available. Passenger service in Carroll County was curtailed some years ago.

The Carrollton line was recently extended beyond Ghent to the new Kentucky Utilities' generating plant and the coal processing plant near the Gallatin County line. It is expected that the coal processing plant, where coal will be transferred to barges, will become a major distributor of coal along the Ohio River starting in 1977. (Watkins and Associates 1974)

2.2.3.1.2 Air Transportation

The nearest commercial airport is the Greater Cincinnati Airport in Boone County, Kentucky, about 45 miles from Carrollton. Standiford Field at Louisville is about 50 miles away. Both of these airports are large, modern facilities offering a complete variety of air service and connections. The primary connecting route between Carroll County and these two airports is I-71. By this route, either airport can be directly reached on a modern, interstate highway in less than one hour's driving time from Carrollton.

A general aviation public airport has been approved by Federal Aviation Administration and the State Department of Aeronautics. It will be designed to handle private and non-scheduled commercial flights. An airport master plan is presently being prepared and final design of the airport will begin as soon as the proposed site has been selected. (Watkins and Associates 1974)

2.2.3.1.3 Water Transportation

Carroll County's northern border fronts for more than 20 miles on the Ohio River, one of the major navigable waterways in this county. The Kentucky River, also a maintained navigable waterway, bisects the County for 10 miles before entering the Ohio River at Carrollton. A 9-foot deep channel is maintained in the Ohio River and a 6-foot channel in the Kentucky River. Stable pools have been created in both waterways by lock and dam systems.

The Kentucky River is navigable 259 miles upstream to Beattyville. It comprises a system of 14 locks and dams, the first five of which were developed by the Commonwealth of Kentucky and ceded to the United States in 1880. The latter nine were developed by the Federal Government in 1917. The Kentucky River navigation system is now obsolete. Approximately 680,000 tons of traffic are still shipped each year, almost all of which are inbound shipments of sand, gravel and crushed rock.

The entire 981 miles of the Ohio River from Pittsburgh, Pennsylvania to Cairo, Illinois, have been improved since the first locks were built at Louisville in 1852. Canalization of the river was completed in 1929. Direct connections for shipments over the inland navigation system as well as the Great Lakes system and the Gulf Intercoastal Waterway are afforded to Carroll County by the Ohio River. More than 130 million tons of freight are shipped on this waterway a year, two-thirds of which are bulk forms of energy such as coal, crude oil and petroleum products. Each year the amount of freight traffic on the river increases.

> *These two waterways initially had a very strong influence on the development of Carroll County. With the advent of rail and highway transportation, however, the importance to the County of water transportation has declined. No port facilities have been developed and use of the rivers has been largely limited to sporadic shipments of sand and gravel.*
>
> *The Carroll County Planning Commission recommends that continued attention be devoted to the fulfillment of the great water transporation potential on both the Kentucky and Ohio River waterways. Plans should be prepared for the development of a terminal at Carrollton for private recreational boats to "dock and shop" in downtown Carrollton. (Watkins and Associates 1974)*

Kentucky Utilities' Ghent Station, with Unit 1 now in operation, presently utilizes Ohio River barge transportation to transport coal. At the present time, two to three 6-barge tows of coal are being unloaded per week. When Unit 2 comes on-line, this will increase to four to six 6-barge tows of coal per week.

2.2.3.1.4 Highways and Streets

> *By far the most important forms of transportation to Carroll County are the automobile, truck and bus on the County's highways and streets. Other modes of transportation are used to connect Carroll County to the outside world but the highways and streets interconnect all parts of the County, providing access to every section of Carroll County as well as linking the County with the outside world.*
>
> *Commercial truck and bus transportation is available in Carrollton over the highway system. Two trucking companies have terminals located in Carrollton and several more companies serve the County. Through these truck lines, good service is available to or from all parts of the County. The commercial bus line operates three passenger buses a day through to Cincinnati and four per day to Louisville. Two buses in each direction carry freight in addition to passengers. (See Figure 2.2-4 for the highway system for the three county area.) (Watkins and Associates 1974)*

2.2.4 Community Services and Facilities

There are three major communities within 10 miles of the Ghent Station that will be discussed in this section. These are Carrollton and Warsaw, Kentucky, and Vevay, Indiana. The communities which are most directly related to the Ghent facility are Carrollton and Warsaw, and will receive a more detailed description.

2.2.4.1 Schools

The nearest schools to the Ghent Station are located on the opposite side of the Ohio River in Vevay, Indiana, 2 miles distant. There is a high school and an elementary school located in Vevay. In addition, there are 4 other elementary schools in other parts of Switzerland County. The total estimated 1976-77 enrollment for Switzerland County alone was 1,500.

Carroll County has 3 public schools, consisting of an elementary school, a middle school and a high school. All are located in Carrollton and have a total enrollment of approximately 1,960 students. There is also a vocational school located in Carrollton.

Warsaw (in Gallatin County) has a high school and an elementary school with a total enrollment of approximately 1,000 students.

2.2.4.2 Institutions

There are 2 public libraries in the area, 1 located in Carrollton and another in Vevay.

The nearest hospital to the Ghent Station is located in Carrollton, approximately 8 miles distant. It has 80 beds and provides general hospital care. Neither Gallatin nor Switzerland Counties have hospital facilities. The nearest hospital on the Indiana side of the Ohio River is located in Madison, Indiana, 17 miles distant from the Ghent Station.

2.2.5 Archaeological Areas

Two separate archaeological surveys were completed at the Ghent Station. The first, on 20 April 1976, was a general survey to locate and evaluate any prehistoric archaeological sites which may be impacted by the proposed construction. The results of this survey indicated that a possible site of unknown extent, 15 CL-18, may be situated in the area of the proposed coal yard expansion. On 9 June 1976 a survey to further test the extent of this site was performed utilizing a tractor-mounted backhoe-frontloader supplied by Kentucky Utilities.

The following sections present the results of the 2 surveys. Sections 2.5.1 and 2.5.2 present the physical and archaeological settings, respectively; section 2.5.3 the research techniques; section 2.5.4 the site descriptions; section 2.5.5 the results of machine-assisted archaeological testing and section 2.5.6 the conclusions. Within these sections, general descriptions of all the sites found on the station represent data gathered during the April survey while specific descriptions of site 15 CL-18 represent data gathered from the June survey.

2.2.5.1 The Physical Setting

The survey area is located on a broad terrace overlooking the Ohio River. This section of the river flows through the Eden Shale Belt section of the Bluegrass Region of the Interior Low Plateau physiographic province (Thornbury 1965). The river valley itself is relatively flat with low hills extending generally parallel to the river. The area behind the floodplain is marked by high, steep hills dissected by numerous narrow, deep stream valleys. The local geological outcropping consists largely of Ordovician limestones and shales (U.S. Army Engineer District, Louisville 1973).

The original forest cover of the area was mixed mesophytic in character. Various species of hickory, walnut and oak would have been available as food resources for the prehistoric inhabitants of Carroll County (Braun 1950).

2.2.5.2 The Archaeological Setting

To this date, 10 prehistoric sites have been recorded in Carroll County. Most of these were discovered during an early survey of the commonwealth (Webb and Funkhouser 1932: 71-73). The remaining sites have been more recently located including the 2 found during the Ghent Generating Station survey. The following paragraphs briefly outline the known prehistoric development of the area.

The earliest inhabitants of the area probably entered Northern Kentucky around 14,000 years ago. The Paleo-Indian Tradition lasted until around 8,000 B.C. Sites of the period are recognized by the presence of the characteristic fluted projectile points. These peoples were apparently organized into small bands of related individuals whose economic system was geared toward the exploitation of Pleistocene megafauna. A number of fluted points have been found in the area but no systematic survey or excavation of these sites has yet been undertaken (Rolingson 1964).

The succeeding Archaic Tradition began around 8,000 B.C. and continued until 1,500 or 1,000 B.C. Hunting and gathering of fauna and flora essentially similar to those species available in the area today provided the economic base of the period. The Archaic tool kit included a wide variety of chipped stone implements, bone tools and artifacts manufactured by the pecking and grinding of stone (Willey 1966). A number of sites of the period, ranging from small, temporary camps to fairly substantial occupations which were repeatedly visited by relatively large groups are known throughout the area (Purrington and Smith 1966; Rolingson 1968; Allen 1973).

The Woodland Tradition began around 1,000 B.C. and lasted until approximately A.D. 900. It is marked by 3 significant cultural features-- the developement of agriculture, the manufacture of pottery and the development of an elaborate burial ceremonialism centering around the construction of earthern mounds over the graves of the honored dead. These mounds have been a focus of archaeological research for many years. Village, camp and mound sites have been located throughout the Middle Ohio Valley (Dragoo 1963; Bluegrass Archaeological Society 1976; Collins and Cowan 1976).

The Mississippian and Fort Ancient Traditions began around A.D. 900 and lasted until the historic era. These groups developed an economic system based on maize agriculture. This dependable food base allowed a more stable settlement system and the rise of large permanent villages. A relatively complex social organization is also evident. Sites of the period are numerous throughout the area in both the river bottoms and upland areas (Purrington and Smith 1966; Hanson 1966).

2.2.5.3 Research Techniques

April Survey

All of the proposed construction areas and much of the remaining Kentucky Utilities property were systematically traversed (Figure 2.2-5). The ground surface was examined for evidence of prehistoric occupation. Special attention was given to those areas where plant cover was relatively sparce and the ground surface could be seen. In general, survey conditions were poor. Much of the project site was covered with thick vegetation or buildings and equipment associated with the existing power plant. In no area was more than 5 to 10 percent of the ground surface visible.

With the exception of fire-cracked rock, all cultural materials were collected in paper sacks labeled as to site, collector and date. Written records were kept on site location, size, condition and state preservation. The location of each site was noted on a U.S.G.S. topographic map and a plant map provided by Kentucky Utilities.

Upon completion of the field phase of the project, the cultural materials were returned to Lexington where they were washed, sorted, cataloged and analyzed. These materials were then deposited at the University of Kentucky Museum of Anthropology for permanent storage.

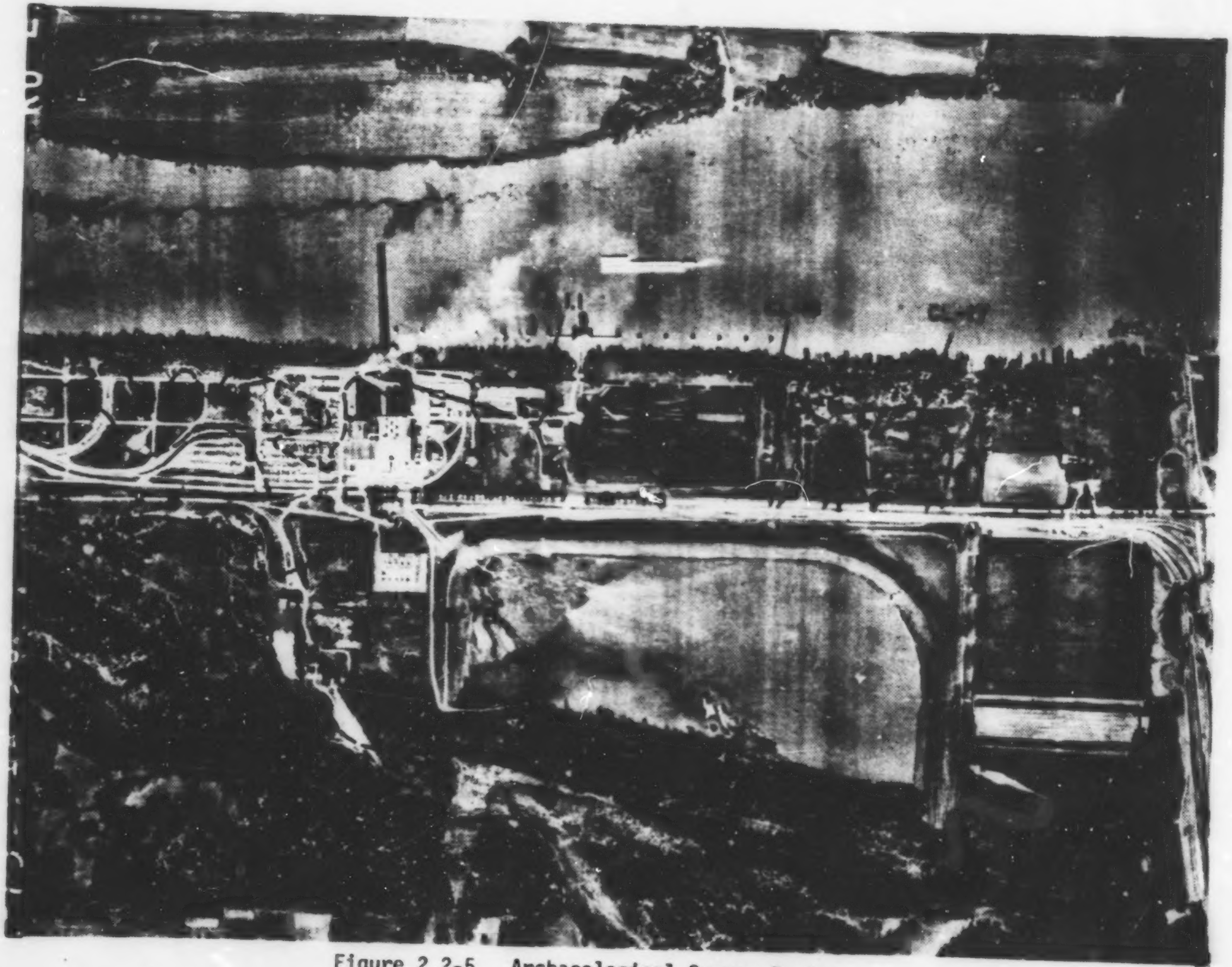

Figure 2.2-5. Archaeological Survey Routes.

June Survey

At the time of the April survey, the only dimension of site 15 CL-18 which could be inferred from surface indications was the roughly east-west extent of cultural material exposed along the bluff's edge. The material was exposed for some 65 meters, centered approximately at the point where a chain-link fence (the eastern boundary of the existing coal storage pile) intersected the bluff. East of the fence, in a small eroded patch about 25 meters from the bluff, were exposed a few fragments of apparently fire-cracked rock and a flake. As this latter spot is directly in the path of proposed expansion of the coal repository, and there seemed to be considerable cultural material eroding out at the top of this bluff, it was recommended that the site be tested.

Archaeological testing is specific application of the broader concept of archaeological sampling universe is of uncertain dimensions (Mueller 1974: 4), thus, in the case of 15 CL-18, it would not be feasible to dig test pits which purport to discover the nature of the site when the size of the site (the sampling universe) is unknown. With this consideration in mind, it was decided to peel away patches of ground cover with power equipment to expose the topsoil and determine the extent of the site prior to testing. It was reasoned that with the horizontal extent of the site determined (and almost certainly something more about its content known), a more adequate sample could be achieved by archaeological testing. Since the site area had obviously been plowed in the past, it was obvious that the use of power equipment would do no damage to the site as long as only previously plowed earth was disturbed.

This strategy was implemented on 9 June 1976. A backhoe-frontloader supplied by Kentucky Utilities was made available. The survey team selected 16 small areas (roughly 3 by 3 meters) distributed over the presumed extent of the site, marked them with survey flags, and removed the sod from each of these using the frontloader (Figure 2.2-6).

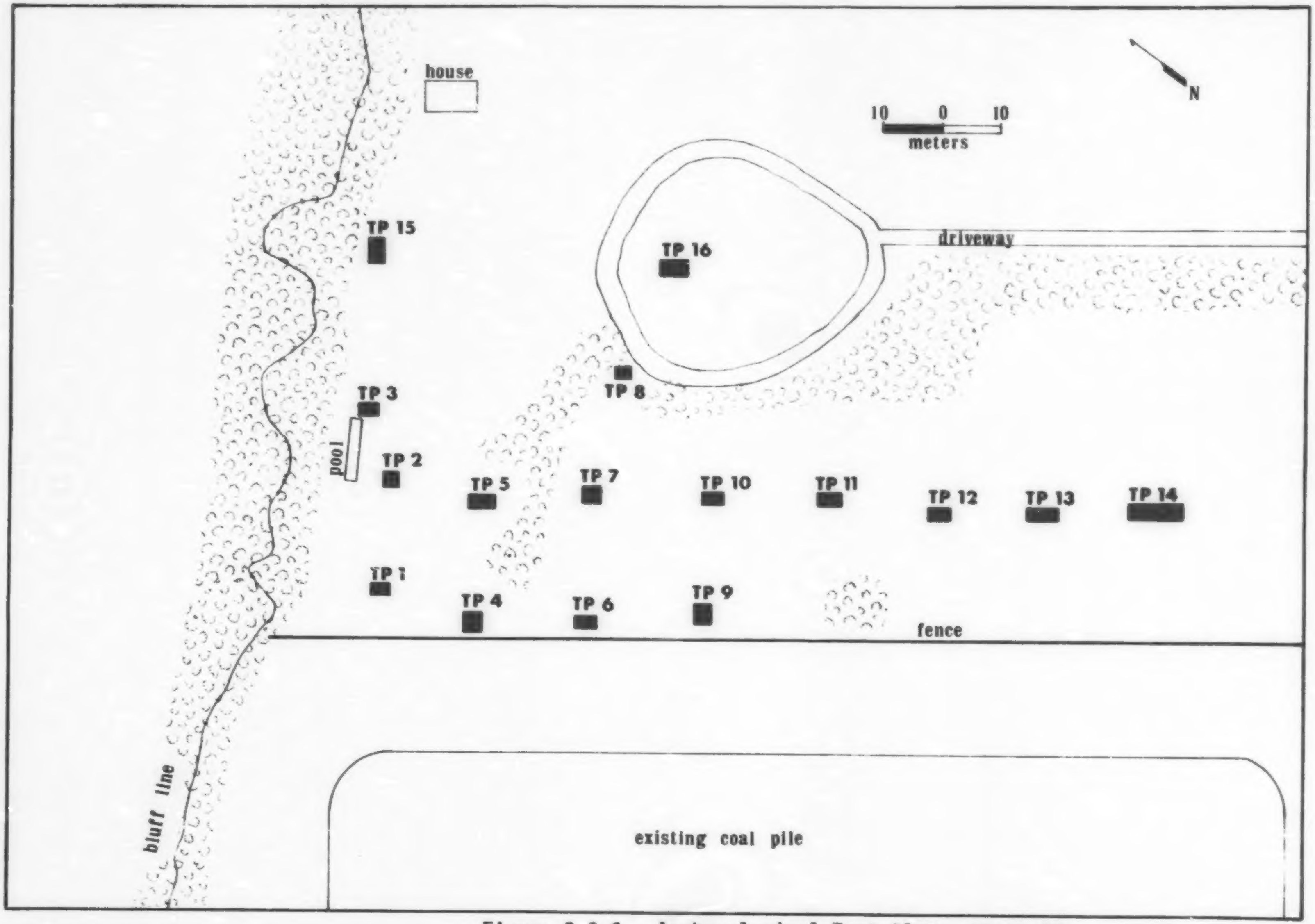

Figure 2.2-6. Archaeological Test Plots, 15 CL-18

Initially, only about 20 cm (8 inches) of soil were removed from test pits 1, 2, 3, 4 and 5. As each cut was taken, the floor of the pit was examined as was the fill removed from it.

After these 5 pits had been scraped down to about 20 cm below the surface, it seemed obvious that the original estimation of the density of cultural material was high. Even when correcting for the fact that only a portion of the cultural material present in a certain deposit will be observed using this excavation technique, very little was showing up in the plowzone fill from these pits. Since the plowzone soil at 15 CL-18 is sandy and was very dry on the day of the testing, it poured out of the frontloader easily, and cultural items could be spotted much more readily than if the soil had been more cohesive. It was then decided to modify the strategy and employ the backhoe to actually test the site.

The testing procedure was to make succeeding cuts of roughly 15 to 25 cm in vertical dimension; the remaining 11 were dug with this technique and the earth removed with each cut was piled separately in order of removal. This resulted in several piles of backdirt, the one nearest the pit coming from nearest the surface and progressively more distant ones from increasingly greater depths. Each load of fill could be identified as coming from plowzone or from beneath plowzone (or, in some cases including some of both kinds of fill). The piles of backdirt from each pit graded in content, color and texture, reflecting the depth from which they were recovered. The uppermost fill was grayish in color and unconsolidated in texture; it contained the humus and grassroots layers. Fill from progressively deeper cuts graded through a light brown (or a medium brown, depending upon the horizontal location) to an orange color and became slightly more compact with depth. Most of these piles of earth were examined, at least to some degree, for cultural materials. Maximum depths of the pits ranged from 20 to 60 cm and averaged just over 40 cm.

Additionally, backhoe trenches were dug along one edge of 3 of the test pits to depths of about 1.50 meters. These provided exposures of the lower subsoil horizons and a more complete picture of the structure site.

2.2.5.4 Site Descriptions

The following section describes the various prehistoric localities that were discovered during the course of the survey.

15 CL-17

This is a habitation site of unknown dimensions located toward the eastern end of the Kentucky Utilities property. It will not be affected by any of the proposed construction. The site is situated 200 yds west of the Carroll-Gallatin County line and 40 yds north of Highway 42. It stretches over the crest of a low ridge which parallels the Ohio River. At the time of the survey, the field in which the site lies was almost completely covered with pasture grass. Consequently, it was impossible to determine the size of the habitation area. Cultural materials were recovered from an area enclosing several small patches of exposed ground surface about 15 yds in diameter. However, less than 10 percent of this area was devoid of vegetation.

The cultural materials observed at and recovered from the site consist of fire-cracked stone and 10 non-utilized flakes.

15 CL-7

One of the goals of the survey was to attempt to relocate a site (15 CL-7) which had been originally discovered by an early archaeological survey of the Commonwealth (Webb and Funkhouser 1932). Although this site was thought to have been within the boundaries of the Ghent Power Plant, its precise location was not known. Webb and Funkhouser's map (1932) locates the site approximately in the area of the switchyards south of Highway 42, and a few specimens found in that vicinity in the course of this survey are possibly associated with 15 CL-7. Three small areas, each of which produced limited amounts of cultural material, were located. These are situated on the south, east and southwest of the existing and proposed switchyard, and it is probable that earth moving activities have already destroyed the central section of the site. The ground surface in the switchyard area had the characteristics of C-horizon soil (subsoil), indicating that the site had probably been removed. The different sections of 15 CL-7 have been labeled areas A, B and C (see Figure 2.2-5). Each of these are described separately below.

Area A is a low hill overlooking a small, seasonally-flowing branch of Black Rock Creek. It is just to the north of a large barn which was part of a now abandoned farm. Cultural materials were found in a cut made by an access road leading to this farm. Materials collected from this area consist of 1 core and 5 non-utilized flakes.

Area B is situated on a low hill located immediately to the south of the east end of the existing switchyard. A small amount of material was collected along a cut bank over a distance of approximately 15 yards. One core and 5 non-utilized flakes were recovered.

Area C is a level field located immediately to the north of the proposed switchyard. Although surface examination conditions were relatively good, only 5 flakes were recovered in an area approximately 25 yards in diameter.

Surface Indications

Surface indications (S.I.) is a term used to designate small areas where limited amounts of cultural materials were recovered and evidence is present that indicates these items may have been moved from their original context. Two such localities were discovered during the course of the survey.

S.I. 1 is situated on the edge of the bluff overlooking the Ohio River. It is just to the west of the conveyer belt extending from the barge unloading dock and is north of Unit 1 Cooling Tower. One non-utilized flake and 1 fire-cracked stone were found at this locality.

S.I. 2 is situated on the slope of 1 of the high hills overlooking the plant site from the south. It is found about midway between the crest of the hill and the base on a small dirt road at a point where it crosses under a power line. The forest cover of this area had recently been cleared and the ground surface was partially graded in connection with the construction of a clearway for the power lines. Consequently, it is evident that the cultural materials have been displaced. One biface fragment and a non-utilized flake were recovered.

2.2.5.5 Specific Results of Machine-Assisted Archaeological Testing of Site 15 CL-18

The prehistoric cultural materials recovered from the test excavations at 15 CL-18 have been divided into 7 classes. These consist of 3 tool types, 3 categories of chert implement manufacture waste and 1 class of cooking unit residue. These are described in the following section along with the historic materials which were recovered. Distributions are presented in Tables 2.2-14 and 2.2-15.

Bifaces, 3 specimens (Figure 2.2-7)

These bifacially modified chert implements were recovered from 2 different test pits. All were either broken or discarded during the process of manufacture.

One specimen is more or less teardrop in shape with a pointed end and convex base. The lateral edges are asymetrically excurvate. Primary flake scars are wide and relatively shallow. No secondary flake scars or edge wear is visible. The cross-section is plano-triangular. This specimen measures 48 mm in length, 22 mm in width and 13 mm in thickness.

The second specimen is asymetrically ovate in shape. A strongly excurvate and straight lateral edge merge to form a blunt, pointed end. The base is straight and flat. It is unmodified and cortex still remains. The cross-section is asymetrically biconvex. Primary flake scars are wide and relatively deep with a number ending in hinge scars. A few narrow, shallow secondary flake scars are visible on one edge. This specimen measures 63 mm in length, 45 mm in width and 17 mm in thickness.

The third biface is a midsection fragment of an unfinished specimen. Bifacial flaking is present on one edge only. The primary flake scars are wide and shallow and no secondary flake scars or edge wear is visible. Cortex remains on one face.

Table 2.2-14

Distribution* of Prehistoric Artifacts

Provenience	Biface	Utilized Flake	Hammer-Stone	Core	Chunk	Flake
TP 1, 40-45 cm	1	0	0	0	0	1
TP 1, 45-55 cm	1	0	1	1	0	3
TP 2, BKD	0	0	0	0	0	3
TP 3, BKD	0	0	0	0	0	7
TP 4, BKD	0	0	0	0	0	1
TP 5, BKD	0	0	0	0	3	2
TP 6, BKD	1	0	0	0	0	0
TP 7, BKD	0	0	0	0	0	0
TP 8, BKD	0	0	0	0	0	3
TP 11, BKD	0	0	0	2	1	2
TP 11, 20-25 cm	0	0	0	0	1	1
TP 11, 51 cm	0	1	0	0	0	0
TP 13, BKD	0	0	0	1	0	0
Total	3	1	1	4	5	25

* Vertical distributions are given as BKD = backdirt or in centimeters below surface.

Table 2.2-15

Distribution of Historic Artifacts

Type	TP 3 BKD	TP 5 BKD	TP 6 BKD	TP 7 BKD	TP 8 BKD
Crockery	1	0	0	0	0
China	0	2	0	1	0
Window Glass	0	0	2	0	0
Bottle Glass	0	0	2	1	1
Wire	0	0	0	0	1
Nail	0	0	0	0	1
Calf Radius	0	0	0	0	1
Total	1	2	4	2	4

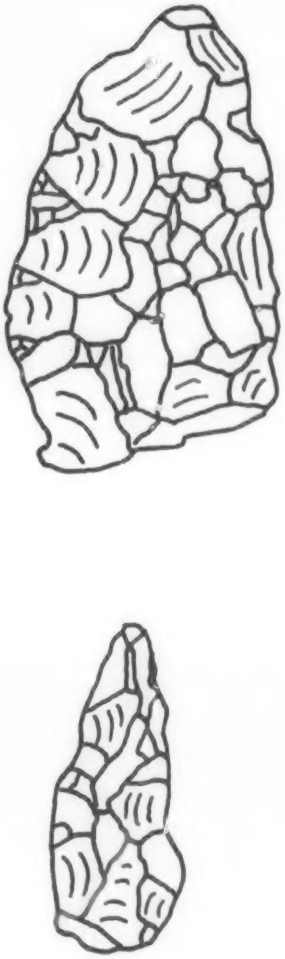

Figure 2.2-7. 15 CL-18 Bifaces.

Unifacially Worked Flake, 1 specimen

This specimen, exhibiting use wear or unifacial modification along one edge, is made from a secondary decortication flake. It is 36 mm long, 32 mm wide and 5 mm thick.

Hammerstone, 1 specimen

This chert tool manufacturing implement is made from a light brown quartzite pebble. Heavy battering scars are visible on all edges and on one face. The specimen is 82 mm long, 77 mm wide and 48 mm thick.

Cores, 4 specimens

These specimens represent chert cobbles from which flakes have been removed as part of the tool manufacturing process. One is relatively large (70 mm by 50 mm by 28 mm). It is ovate in shape and flakes have been removed from both faces.

The remaining 3 cores are small cobbles which exhibit flake removal at one end only. They measure between 36 mm and 43 mm in length, from 24 mm to 32 mm in width and between 19 mm and 22 mm in thickness.

Chunks, 5 specimens

These thick, blocky shaped pieces of chert are interpreted as being the byproduct of implement manufacture in which the stone contained fractures or impurities which resulted in unintentional breakage during the flaking process.

Flakes, 25 specimens

Thirteen unmodified flakes were broken and lacked striking platforms. Of the 12 complete specimens, 4 had a small, protruding lip extending over the interior side of the flake at the striking platform. This is interpreted as being the result of direct percussion with a soft hammer implement such as a bone or wooden baton.

Eight specimens had platforms whose junctures with the interior surface of the flake was smooth and unlipped. This probably resulted from direct percussion with a hard (stone) hammer.

Twelve flakes exhibited cortex on all (6 specimens) or part (6 specimens) of the exterior surface. Seven flakes showed evidence of thermal damage.

Fire-cracked Stone

Although these materials were not systematically collected, they were observed, in varying amounts, in most of the test pits. They are quartzite or sandstone river pebbles which are heavily oxidized and fractured along angular cleavages. The individual specimens range in size from approximately 2 cm square to 1 large stone, recovered in test pit 12, which measured 13 cm by 12 cm by 5 cm. Most specimens averaged around 5 cm on a side. The relatively large size and heavy weight of the cracked stone on the site would seem to indicate that they were not deposited in the area by stream action or other natural processes. They are, therefore, thought to be human transported, probably functioning in cooking activity.

Historical Material

A number of historic artifacts were recovered in various test pits (Table2.2-15). These undoubtedly relate to the house which once stood on the site. The materials include 1 crockery sherd, 3 china sherds, 2 fragments of window glass, 4 glass bottle sherds,1 piece of wire, 1 wire nail and the distal end of a calf radius.

2.2.5.6 Conclusions

A total of 3 sites and 2 surface indications were located during the course of the first survey. Only 1 of these, 15 CL-18 produced diagnostic artifacts. The 2 limestone tempered cordmarked sherds from the site indicate a Woodland occupation.

15 CL-7, if in fact correctly identified, appears to be largely destroyed or disturbed. Consequently, no further mitigating action is recommended.

15 CL-17 was largely covered with pasture grass at the time of survey. This situation resulted in very poor surface examination conditions. Given the small amount of visible ground surface, the number of cultural materials recovered was fairly substantial. Consequently, it is believed that this site has potential significance. However, it will not be affected by the proposed construction and no further mitigating action is necessary at this time. If future construction is planned for this area, test excavations should be conducted at 15 CL-17 to determine potential sub-surface deposits and features. State agencies concerned with prehistoric or historic archaeological artifacts will be permitted, by prior arrangement with Kentucky Utilities, to further investigate this site.

15 CL-18 contained limited cultural material indicating limited use of the locality at an undetermined time in the prehistoric past. The 2 small sherds recovered during the survey are the only clues to the cultural assignment of the site--i.e., Woodland period. It is uncertain what forces brought the numerous pebbles and cobbles to rest at this locality. It is possible that some of these are the result of cultural activity, but their occurrence in areas (e.g., test pits 13 and 14) apparently outside of the site in roughly the same frequency as inside of the site raises the possibility that at least some of them may be natural inclusions in the terrace deposits.

Stone chipping is about the only prehistoric activity clearly identifiable at this site (the flakes and evidently unfinished bifaces), so site function is uncertain.

It is felt that the 16 test pits would have encountered evidence for features or larger quantities of sub-plowzone artifacts if these were at all characteristic of this site. It is therefore concluded that little worthwhile additional information would be gained by further work at 15 CL-18.

S.I. 1 appears to be of minimal size and importance. Also it is apparently not in an area which will be affected by future construction. Consequently, no further mitigating action should be necessary.

S.I. 2 is also apparently insignificant and already destroyed. No further mitigation is recommended.

2.2.6 Historical Areas

The area in which the Ghent Station is located is rich in historical significance. Ghent was settled in 1795, 3 years after Carrollton was first settled. The town was originally known as McCool's Creek. In 1814, Henry Clay, the famous Kentucky statesman, while a visitor there, was asked for a suitable name of the town. He suggested the name Ghent since he had just returned from Ghent, Belgium where he had been a member of the Peace Treaty Commission. Many early settlers came from Virginia after the Revolutionary War while others entered Kentucky in 1781 with the Traveling Church. Others yet brought their families and livestock down the Ohio River in flatboats. Ghent was incorporated as a town on January 18, 1824 (Parker 1956).

In Carroll County there are 2 structures that are listed by the Kentucky Heritage Commission as historical sites. These are:

> *Butler, Gen. William O., House. Highland Avenue, Carrollton, Carroll County. 183[illegible]. Hero of the American Revolution, War of 1812, Mexican War; representative in State Legislature 1817-1818 [illegible] Congress 1839-1843; Democratic candidate for gov[illegible]ntucky in 1844.*
>
> *Grass Hills. Eagl[illegible]tation Road, Carroll County. 1819-1823. Large log house built by Lewis Sanders, who earlier had built the first factory run by steam in Kentucky and held the first cattle show and fair west of the Appalachians at his farm near Lexington. (Kentucky Heritage Commission 1975)*

Located on the property of the Ghent Power Station are several structures that could possibly be of some historical significance. On the south side of Highway 42 is a small log cabin that dates to pre-1883 (Lake 1883). This cabin is in fair condition with no real historical significance except for its age. Near the cabin is a fairly large barn built around another barn frame of older origin (pre-1870's). The barn is not significant in itself; however, it contains a full size hay press of historical significance. Near the Ohio River next to the proposed coal yards is a group of buildings all dated from recent history except for a log constructed barn of unknown age. A small cemetery dating back to the 1830's is also located in this area.

The assessment made by the Kentucky Heritage Commission is that none of the previously mentioned structures are eligible for inclusion in the National Register of Historic Places. There are no objections, therefore, to their relocation and/or demolition. The hay press does, however, deserve attention and if the building housing it is ever in the way of plant expansion, the hay press should be removed and preserved (Kentucky Heritage Commission 1976).

2.2.7 Sensitive Areas

Sensitive areas are areas valued for their natural historic, scenic or cultural significance which may be affected by plant construction or operation. The following subsections will describe any such areas affected by Ghent Station Units 3 and 4 and associated transmission facilities.

2.2.7.1 Sensitive Natural Areas

Sensitive natural areas are those which are valued as natural habitats for plant and/or animal species. These would include any natural breeding and spawning areas and areas which are suitable as habitats for rare and/or endangered species.

The existing Ghent Station occupies land that was earlier established as farmland and has presently, through the operation of Units 1 and 2, established the land within the plant boundaries for use in power production. This area is, therefore, not considered a sensitive natural area.

Outside the plant boundaries is an area which could be deemed as a sensitive natural area. Black Rock Creek, which drains a major portion of the Ghent Station, could be included as a sensitive natural area (Figure 2.2-8). Because of the construction of navigation dams on and channelization of the Ohio River, small tributaries have received an increased value as habitats for spawning of some important fish species of the Ohio River (ORSANCO 1962, 1976). This is due to the limited number of undisturbed weed beds or shallow areas now present in the Ohio River main stem.

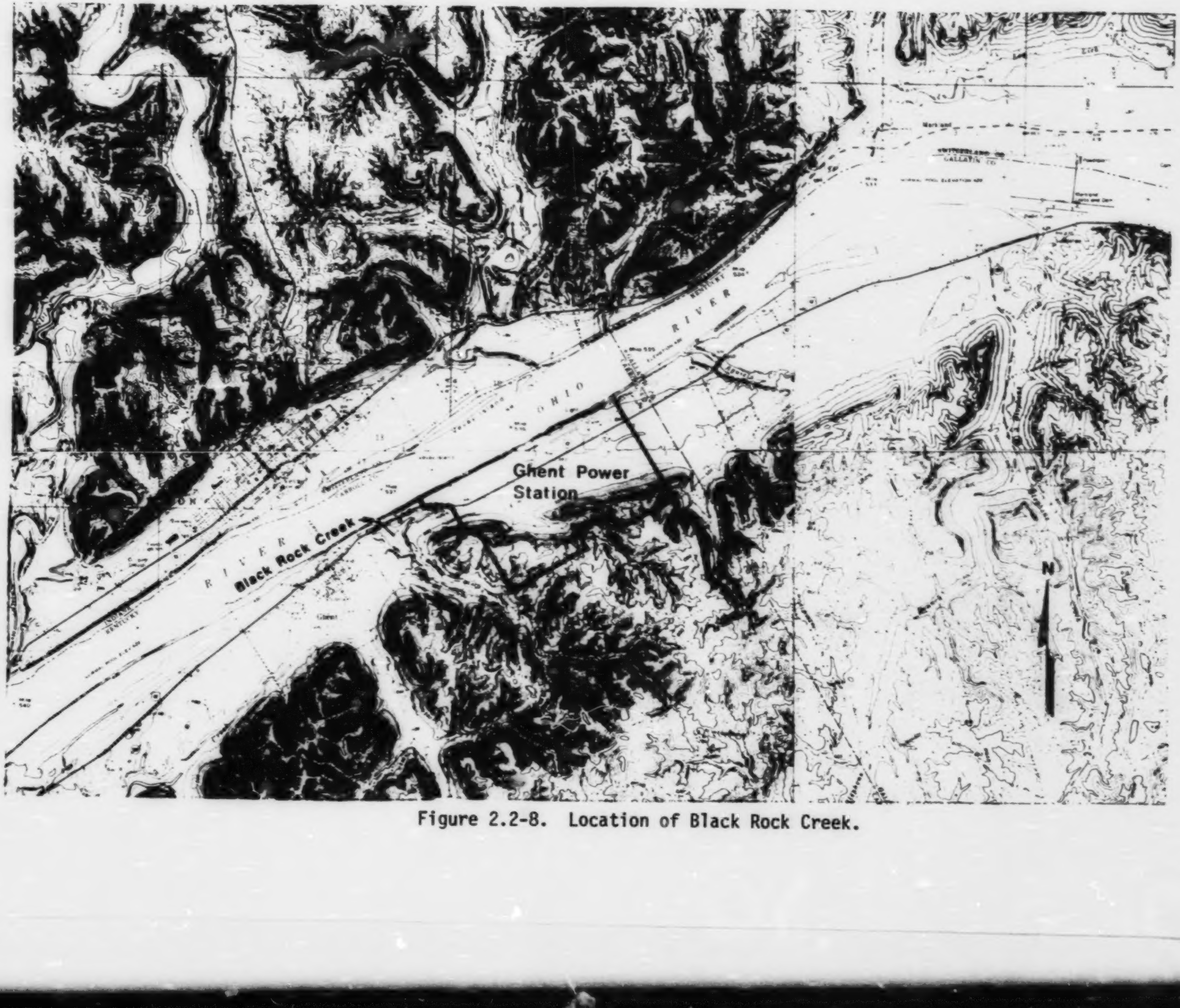

Figure 2.2-8. Location of Black Rock Creek.

2.2.7.2 Sensitive Man-made Areas

Despite the Ohio River Valley being a rather rich area in terms of archaeological sites, the results of a survey performed at the Ghent Station showed no significant sites worth mentioning as a sensitive area. Also, the buildings that are on the Ghent Station, though some dating back to the early 19th century, are deemed to be of little historic significance (Kentucky Heritage Commission 1976).

Outside the Ghent Station boundaries lie several areas of some importance historically and culturally. Of the most important is General Butler State Park located approximately 6 miles southeast of the Ghent Station. The park exhibits a scenic view of the Ohio River and is historically significant as containing the home of General W.O. Butler. On 809 acres, the park contains recreational facilities for golf, swimming, boating, ice skating, horseback riding and a mini-train. Due to the park's nature and the large number of people it attracts, it can be termed a sensitive man-made and natural area.

2.3 ENVIRONMENT WITHOUT PROPOSED TRANSMISSION LINE

All three of the proposed corridor routes lie within an area approximately 15 miles wide and 40 miles long (Figure 2.3-1). The following sections will include a description of the natural and man-made environments plus a description of the sensitive areas encountered in either locale.

2.3.1 Natural Environment

The routes being considered for the Ghent-West Frankfort lines cross the northwest central part of the Bluegrass physiographic region of Kentucky (McFarlin 1943). More precisely, these routes rise from the Ohio River alluvial valley on the north and cross the Eden Shale Belt division of the Bluegrass region to terminate on the south just inside the edge of the Inner Bluegrass division. The portion of the Eden Shale Belt traversed by these alignments is interrupted by the broad valley of Eagle Creek and the deep, wide gorge of the Kentucky River. Physiographically, from north to south, the area to be traversed includes the following: (1) the moderately narrow, level Ohio River alluvial terraces of Quaternary age, (2) a band of angular but maturely eroded Ordovician limestone and shale hills, (3) the broad though gently rolling Eagle Creek Valley with its alluvial terraces and low, rounded Ordovician limestone hills, (4) a second stretch of maturely eroded shale and limestone hills, (5) the deep Kentucky River gorge with low bottomlands of varying widths and steep walls of Ordovician limestone, (6) a third segment of mature hills, and (7) the rolling and less deeply eroded Ordovician limestone hills of the inner Bluegrass near the southern end of the route (McFarlin 1943).

2.3.1.1 Soils

Soils range from the alluvial (sands, silts and gravels) bottoms of the Ohio River, Eagle Creek and the Kentucky River to a variety of upland soil series derived from the weathering of bedrock under forest cover. The principal upland soil series are Lowell, Shelbyville, Fairmont, Eden and Nicholson. Lowell and Shelbyville are dark silt loams occurring where limestones and siltstones are the parent rock types. The upland soils of the Fairmont series are dark silty clay loams derived from limestone, whereas those of the Eden series are light colored silty clay loams and clays derived from interbedded calcareous shales, siltstones and sandstones, are brown silt loams

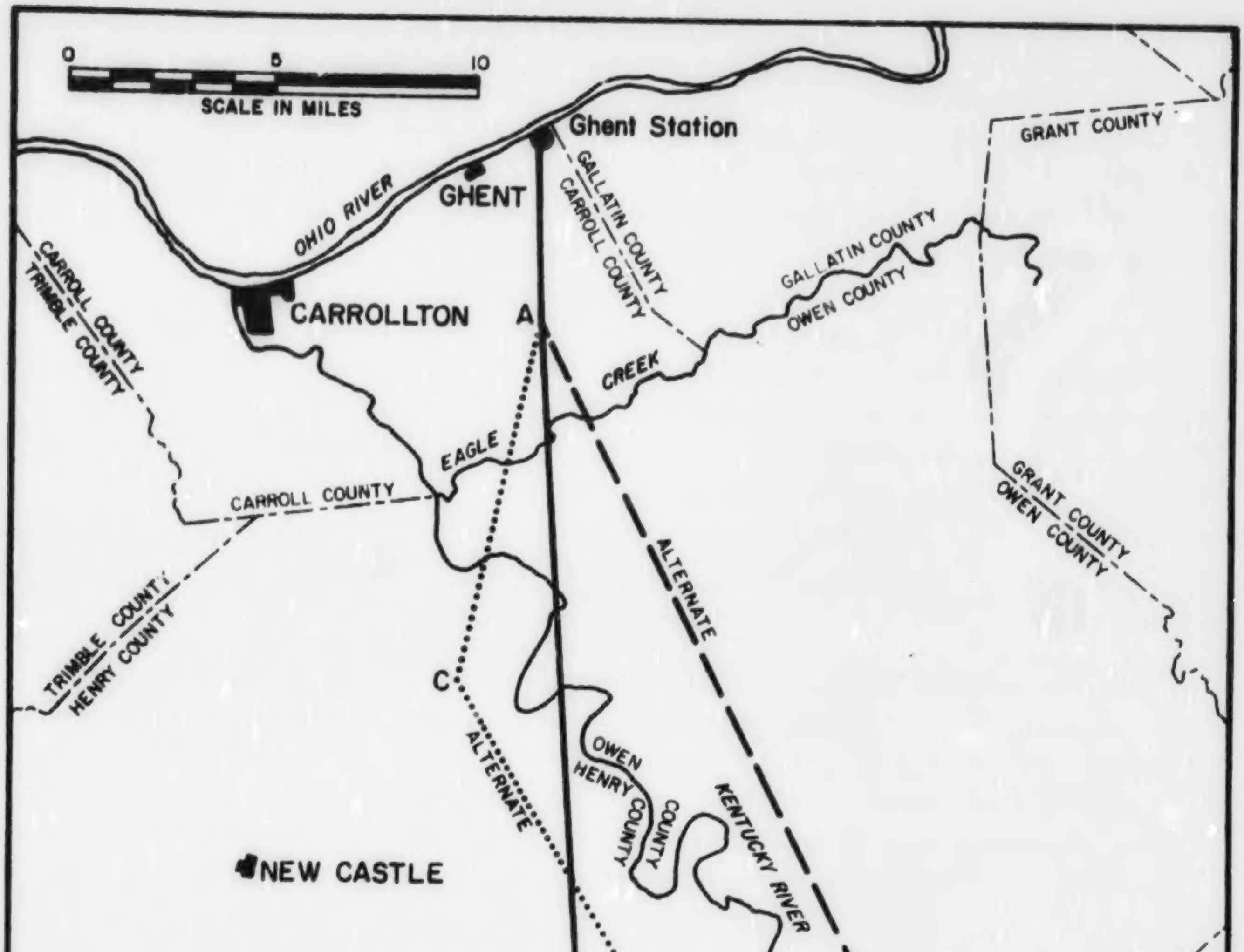

Figure 2.3-1. Preferred and two alternate transmission routes.

with clayey subsoil. Eden and Fairmont soils are the most extensive and are best suited to pastures and hay. Cultivated crops (e.g., corn, tobacco, small grains) are produced on the Nicholson, Shelbyville and Lowell soil types (University of Kentucky Cooperative Extension Service; Bailey and Winsor 1964).

Soils of the Captina and Wheeling series vie with the Huntington and Newark series for the bottoms and terraces in the upper Kentucky River Basin. These soils developed in alluvium washed chiefly from soils of limestone origin, except for the Wheeling series, which was formed in stratified alluvium of very mixed origin. They are noted for production of various agricultural crops (e.g., corn, soybean, tobacco), (Bailey and Winsor 1964; U.S. Army Engineer District, Louisville 1975).

2.3.1.2 Hydrology

All the land within the three proposed corridor routes is included within the upper portion of the Kentucky River Basin. This area lies in the Hills of Bluegrass, which comprises about 16 percent of the total watershed. Eagle Creek, the principal tributary of the Kentucky River in this region, drains approximately 525 square miles. Numerous streams and creeks of various sizes form a dendritic drainage system which is characterized by V-shaped valleys and narrow ridges (Jones 1973).

2.3.1.3 Vegetation

A literature search was conducted in order to find those vegetation elements that have been listed as occurring in the general areas of the study. Sources included Bailey 1949; Braun 1943; Braun 1950; Duncan 1975; Duncan and Foote 1975; Fernald 1950; Gleason and Cronquist 1963; Gunn 1968; Meijer 1971; Meijer 1972; Peterson and McKinney 1968; Petrides 1958; U.S. Department of Agriculture, ARS 1971; Wharton and Barbour 1971; Wharton and Barbour 1973. Gleason and Cronquist (1963) was used as the ultimate taxonomic authority for species names. Other information was derived from two detailed vegetation studies in Trimble County in 1975 which developed lists of plant species occurring in plant communities near Corn Creek and in the surrounding upland areas (Water Resources Laboratory 1975). Vegetation data were also available from a recent Louisville District Corps of Engineers study along Eagle Creek in Owen and Grant counties, Kentucky, a portion of which is near the preferred utility line route. Aerial photographs were also available for the area and these were carefully studied in order to assess the nature of vegetation to be affected by the clearing operations along the corridors. Site visits were made and vegetation assessed at 10 points along the preferred route and the two alternate routes.

Floristically, the [illegible] routes are within the Western Mesophytic Forest region which is part of the Deciduous Forest formation (Braun 1950). Kuchler (1964) considers the potential vegetation of the area to be Oak-Hickory forest (*Quercus - Carya*) whose dominants are bitternut hickory, shagbark hickory, white oak, red oak and black oak. Other components are *Fraxinus americana, Juglans nigra, Prunus serotina* and *Quercus muhlenbergii*. The original vegetation of the rolling terrain of the Outer Bluegrass region included beech, bur oak, white oak, blue ash, white ash, hackberry, sugar maple, black walnut, black cherry, honey locust, Kentucky coffee tree, American elm, Ohio buckeye, black locust, red mulberry, bitternut hickory and [illegible] hickory (Braun 1950). The hilly Eden Shale Belt, underlain by mudstones and [illegible], originally was an oak or oak-hickory belt but subsequent erosion has changed [illegible] greatly (Braun 1950). The advent of man has changed the entire region from one of extensive forests to one of croplands, pasturelands, and other artificial communities. At the present time, about 70-80 percent of the area consists of such communities with the remainder being intensively cut-over upland woods, bottomland woods, floodplain areas, or riparian communities. The diverse topography of the study area varies from poorly drained bottomland and stream sides to dry, excessively well-drained ridges and hilltops. Diversity of slope aspect, variations in slope steepness and local soil conditions will determine the tree cover of the wooded areas. The best developed forests occur on moderately steep east or north-facing slopes and are dominated by sugar maple, basswood and white ash. Among the groundcover species are the common spring ephemerals. The drier south- or southwest facing slopes contain yellow oak, black oak, cedar and hickory. On steep hillsides, where direct penetration of light from the side is possible, these xeric forests are relatively stable. In Appendix A-5 are listed the species of plants as they are known to occur or are expected to occur in the major plant communities of the study area.

A list of threatened or endangered species of plants that have been reported to grow in Kentucky is given in Appendix A-6 (Federal Register, Vol. 40, No. 127, 1975).

Most of the species listed occur in specialized habitats such as bogs which have not been found in the study area, or they occur in regions outside of the area. None of the listed species have been observed in the study area, nor in the areas adjacent to it.

2.3.1.4 Wildlife

2.3.1.4.1 Amphibians and Reptiles

Appendix A-7 is a list of the common and scientific names of the amphibians and reptiles that would be expected to occur along the corridors in Carroll, Henry, Owen and Franklin counties. This list is a compilation from Conant (1958), Barbour (1972) and Minton (1972).

Distribution data on these reptiles and amphibians within Kentucky are not very satisfactory. County records by specific localities with collections are seldom available. Expected occurrence is based upon general range and distribution maps of these species. As with other faunal groups in Kentucky, an interesting mixture of northern and southern elements are encountered in this area, and this mixture and interaction between forms has not been studied in detail. None of the listed species are considered to be endangered or threatened with extinction, although several (broad-headed skink, red-backed salamander, four-toed salamander, red milk snake, prairie kingsnake) are considered rare and/or endangered in Kentucky (Kentucky Academy of Science 1973).

2.3.1.4.2 Birds

In his study of the birds of Kentucky, Mengel (1965) noted that the ornithological knowledge of the bluegrass region of Kentucky (which includes all but the southernmost ends of the three transmission corridors) is fairly extensive, particularly because of its proximity to Louisville and Jefferson County. Mengel and Monroe have worked for many years in Oldham County which adjoins Henry County on the east, and Mengel himself spent much time studying the birds of the region (Mengel 1965; Monroe 1975).

At least 182 species of birds are known to occur in the areas under observation. Appendix A-8 contains a complete list of these species with indication of their status as migrants, residents, breeding residents, etc. Also indicated are those species which have been observed in Trimble County (Water Resources Laboratory 1975) in 1975 (Trimble County is approximately 50 km to the west of the study area), and those species which were observed along the transmission corridors on a 21 August 1975 field trip to the area. A few additional species were taken from a list of birds presented for Grant and Owen counties in U.S. Army Engineers District, Louisville, Kentucky (1973).

The only bird species which may be found in the area which is also on the endangered and threatened list of the Department of the Interior (U.S. Fish and Wildlife Service 1975) is the southern bald eagle, an occasional visitant in the area. The osprey has been observed along the Ohio River 30 km to the east of the study area (Public Service Indiana 1975).

It may be that the vesper sparrow (*Pooecetes gramineus*) breeds in the area since nests have been recorded and birds seen in Gallatin, Boone, Kenton, Grant, and other counties to the north and east. This may also be true of the upland plover (*Bartramia longicauda*) which has been recorded nesting in Boone County and also for Traill's flycatcher (*Empidonax traillii*) which has been recorded nesting in Jefferson County.

There is little doubt that many other kinds of waterfowl and shorebirds visit the area during their annual migrations. Other songbirds, such as the black-capped chickadee *Parus atricapillus*, many migrating warblers (Parulidae), crossbills (*Loxia spp.*), Henslow's sparrow *Passerherbulus henslowii*, Bachman's sparrow *Aimophila aestivalis*, and swamp sparrow *Melospiza georgiana* have been recorded near the corridors, and there is no reason to believe that they may not pass through the area on occasion.

2.3.1.4.3 Mammals

Records of Kentucky mammals were first reported in a systematic manner by Garman (1894). Collection and survey of the fauna continued and culminated in the publication of Wildlife in Kentucky by W.D. Funkhouser (1925). Very little specific information about distribution records by counties is available in the literature. Publication of Barbour and Davis's Mammals in Kentucky in 1974 does not correct this deficiency in the mammal records, for general U.S. distribution maps for many of the mammals illustrate the general range of the species. In a few instances, Kentucky state maps illustrate occurrence data by counties (Barbour 1956a, 1957). There is little or no specific information about mammalian fauna for the study area.

Appendix A-9 is a list of the common and scientific names of 43 mammals that are expected to occur along the corridors with their economic importance. Species actually observed (or signs thereof) in Trimble County in 1975 or along the transmission corridors on 21 August 1976 are indicated by footnotes on this table.

The Indiana bat, *Myotis sodalis*, is listed by the U.S. Department of the Interior (Federal Register, Vol. 40, No. 127, 1975) as rare and endangered. This bat is known to inhabit limestone caves all across the eastern two-thirds of northern Kentucky, but we know of no authentic records from any of the counties within the corridors. Still, it seems likely that the Indiana bat visits the area at some time or another. The bobcat, *Lynx rufus*, has been recorded in Indiana near Trimble County, Kentucky (Public Service Indiana 1975), and while it is not on the rare and endangered list, it is a rare mammal in Kentucky.

2.3.2 Man-Made Environment

The cultural landscape of today is principally one of rural, agricultural land use with some small communities, a few areas--along the Kentucky River--of recreational residences, and--in the northern part of the study area--a growing number of small acreage "commuter" residences. In the Eden Shale Belt, one observes approximately 15 percent cropland, 75 percent pastureland and 10 percent woodland. In contrast, the outer bluegrass land use figures are more nearly 60 percent cropland, 35 percent pastureland and 5 percent woodland. These figures do not, however, apply to the steep margins of the major streams nor to the valley bottoms where, respectively, higher and lower percentages of woodlands generally occur (University of Kentucky Cooperative Extension Service). Communities in this area are all small, and most residences would be classified as rural.

2.3.2.1 Archaeological

A literature search was conducted in order to find available information on known prehistoric sites in the study area. This included a review of the archaeological site record files of the Museum of Anthropology and the University of Kentucky plus the archaeological records of the Kentucky Heritage Commission and the Federal Register. Site inspections were made as well as interviews with certain professional and non-professional archaeologists familiar with the region.

The prehistoric cultural remains of the Bluegrass region of Kentucky are generally viewed according to a Cultural-Historical scheme of organization that recognizes a developmental sequence of cultural manifestations beginning in the late Pleistocene and continuing until the arrival of Europeans. This sequence begins with the Paleo-Indian period, characterized by migratory hunting-gathering on a landscape affected by its nearness to the advancing and retreating edge of the Laurentian Ice Sheet. Near the end of the Pleistocene, as environmental conditions became more as they are today, the Paleo-Indian cultural form gave way to a somewhat different mode of hunting-gathering known as the Archaic. Archaic hunter-gatherers maintained an apparently very successful adaptation to their environment until several technological advancements, in the first millennium B.C., gave rise to a more complex lifeway known as the Woodland. During the Woodland period, rudimentary agriculture, pottery and evidently greater complexity in the social-political realm resulted in the distinctive cultural forms, Early Woodland (Adena), Middle Woodland (Hopewell), and Late Woodland (Newton). Near the end of the first millennium A.D., Village Farming (Mississippian and Fort Ancient) became the dominant cultural manifestation in the Bluegrass. By the time Europeans arrived, the bluegrass region was not intensively used by American Indians, however, campsites of Shawnee and use of the region by Miami, Iroquois and other groups are recorded (Goodell 1971 a, b, c; Willey 1966; Clark 1974).

A detailed review of each cultural historical period of the Bluegrass region of Kentucky is described in Section 2.1.6.2.

2.3.2.2 Archaeological Sites Along the Proposed Routes

There are many prehistoric sites in certain places along the proposed routes, although very few of these have been the subject of careful study. An area defined as lying within 5 miles of the proposed transmission routes was examined in this study.

The records of the Museum of Anthropology at the University of Kentucky list 27 sites in this area, but only those sites which lie within one mile of the proposed routes will be listed (Owen County sites 1, 2, 6, 7, 9, 10, 11; Henry County sites 3 and 4; and Franklin County sites 3 and 7)(Figure 2.3-2). There are a number of these sites which are poorly documented and the existing records cannot be used to contribute substantive knowledge to the prehistory of the region; however, their presence constitutes an indication of site distributions in the area.

The recorded sites in the Owen County portion of the examined area include 4 with single earthen mounds, 6 with both earthen mounds and village refuse present, one with a single stone mound, 2 with multiple mounds present, and one village site.

Henry County sites recorded include a Fort Ancient village (HY3) and a site of uncertain cultural affiliation (HY4).

The Franklin County sites recorded in the files of the University of Kentucky (see also Webb and Funkhouser 1932) are a rockshelter with midden refuse (FR7) and a campsite of uncertain cultural affiliation (FR3, reported by Allen 1976).

Also, a recent survey in portions of Franklin County by personnel of the Kentucky Heritage Commission has produced information on at least 13 sites in the study area (FR11, 18, 19, 26, 28, 52, 54, 55, 56, 57, 58, 59 and 60) according to R. Boisvert (personal communication)(Figure 2.3-2). These consist of 2 Archaic sites (FR26 and 28), a Fort Ancient rockshelter (FR52), 3 sites with both Archaic and Woodland materials present (FR18, 54 and 60), one site with both Woodland and Fort Ancient remains (FR28),

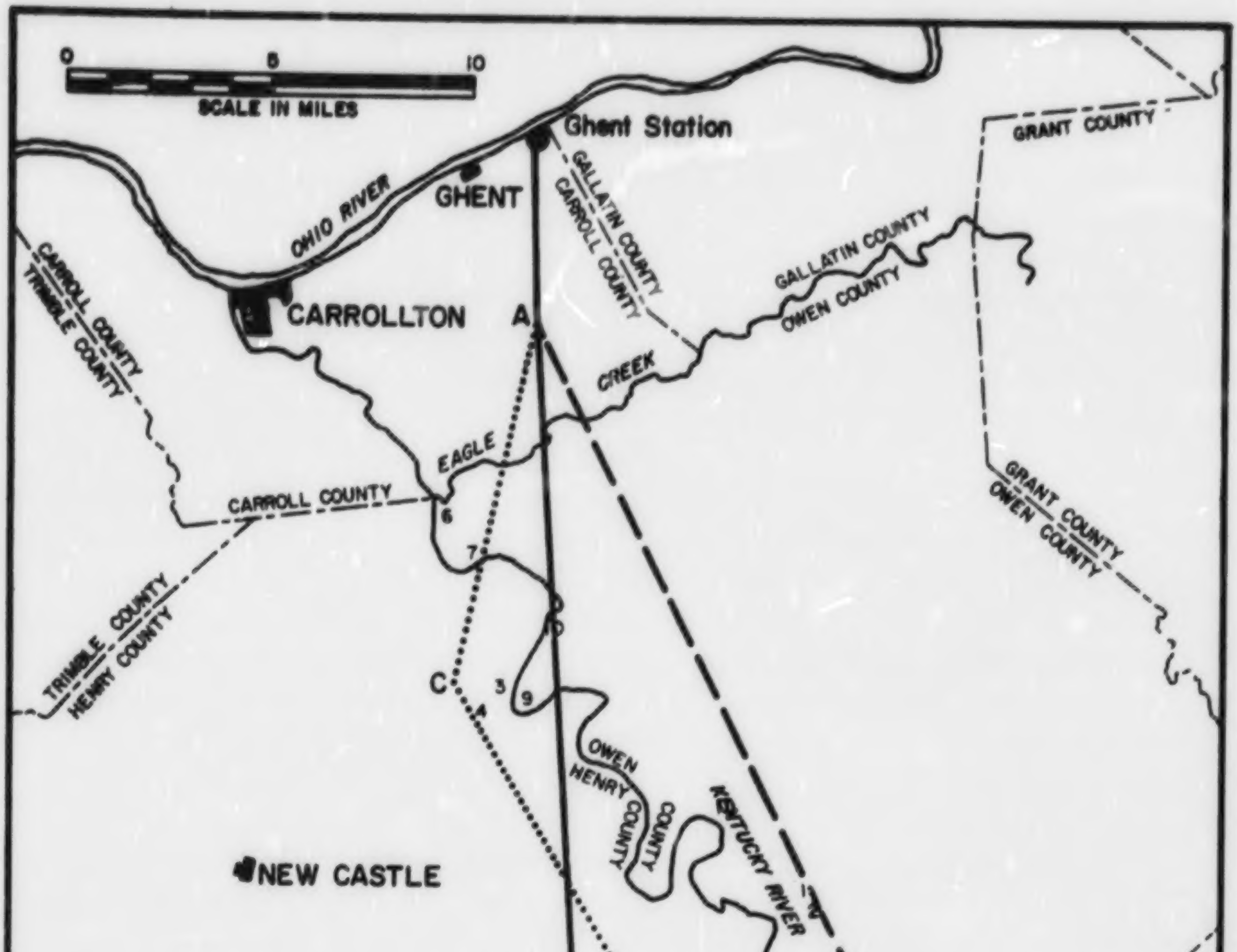

Figure 2.3-2. Archaeological Sites Along the Preferred and Two Alternate Transmission Routes.

and 6 sites of uncertain cultural affiliation (FR11, 19, 55, 56, 57 and 59). The Archaic site, FR26, will be nominated to the National Register of Historic Places as will site FR52 (Boisvert, personal communication). One additional site (FR28, a mound) on the east side of the Kentucky River was also visited by the Heritage Commission archaeologists in their survey.

No prehistoric sites are yet on the National Register of Historic Places in the study area (Federal Register 1976a, 1976b).

Interviews with relic collectors and amateur archaeologists who are familiar with the study area provided additional insight into the nature of prehistoric remains along the proposed routes. One interview brought to light a possible shell midden on the Kentucky River in Owen County. The other persons interviewed offered no clues about sites of different kinds from those documented above; however, they all agreed on 3 points: (1) sites are extremely numerous along the valleys of Eagle Creek, the Kentucky River, Elkhorn Creek, Sixmile Creek and Benson Creek, (2) many sites occur on uplands near these same streams, and (3) sites tend to be less numerous on the high, narrow ridges of the Eden Shale Belt, particularly east of the Kentucky River. A few archaeological materials in private collections from this area were observed during these interviews, and diagnostically Archaic, Adena (possibly Newtown) and Fort Ancient artifacts were noted.

These data and observations, then, would indicate that the study area was intensively, though not evenly, utilized throughout each of the periods of Kentucky prehistory, and that important sites are present in the area.

2.3.2.3 Historical

Five structures of historical value were found in the vicinity of the proposed routes. Verification was done by examining lists of historic sites in Franklin, Henry, Owen, Shelby and Carroll Counties from the National Register of Historic Places (Federal Register, Vol. 41, No. 28, 1976. pp. 5950-5954) and the Survey of Historic Sites in Kentucky and its Supplement (Kentucky Heritage Commission 1975). Glenwood Hall (ca. 1830) and Inverness (ca. 1849)(H1), both architectural examples, are located in

Perry Park, Owen County. Other historical structures located in Owen County are the John Q. Baker House (H2)(Federal 1830), a 1 1/2 story brick residence on Route 1, in Wheatley, and the Thomas Hardin House (H3)(1812), a 2 story brick residence in Monterey. The Penn-Marshall Stone House (H4)(1810-20), a 2 story stone house, is situated east of Harvieland on Stoney Creek Road at the Kentucky River in Franklin County (Figure 2.3-3).

2.3.2.4 Present Land Use

The preferred route encompasses approximately 703 acres of land in the counties of Carroll, Owen, Henry and Franklin and a portion of Shelby County. Of the 703 acres, 63 acres make up the 5.2 mile common corridor near the plant, while 640 acres comprise the remaining 35.2 mile-long corridor. Total acreage of the proposed route is outlined in Table 2.3-1.

Sixty-three percent of the population of these counties live in rural areas. Five towns (preferably called crossroads) lie within 1 mile of the preferred route and have a population of less than 100 people (Table 2.3-1). One of the towns, Perry Park, has a resort development located on the river front. This resort was developed between 5-10 years ago, but has had only limited success.

The proposed route crosses the Kentucky River and about 40 perennial streams of various sizes (Table 2.3-2). Nine major highways, including Interstate 71, and one railroad (crossed twice) are intersected. The railroad to be crossed is the Louisville and Nashville railroad. United States Geological Survey maps indicate that the proposed transmission route will cross 5 other major transmission lines and one pipeline. The route passes within 0.2 mile of both the Twin Eagle Wildlife Management Area and the Eagle Station Recreation Area, but the line does not impinge directly on any significant cultural features (Table 2.3-3) and (Figure 2.3-4 and 2.3-5).

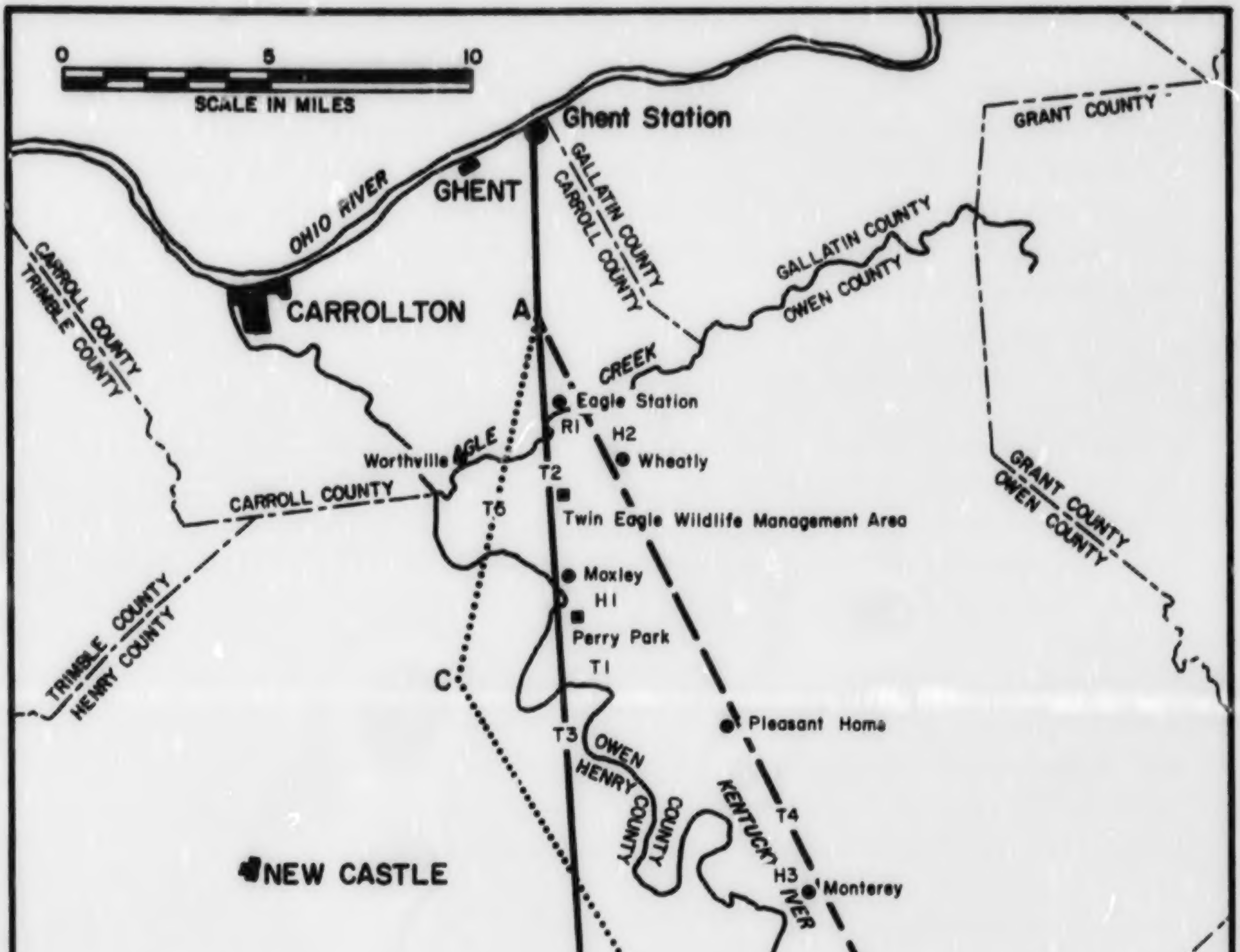

Figure 2.3-3. Historical, Terrestrial and Recreation Sites Along the Preferred and Two Alternate Transmission Routes.

Table 2.3-1

Present Land Use for the Proposed Transmission Route

% Length and Area

% of Total - Area in Acres	100.0% - 703.0
Common Corridor	9.0% - 63.0*
1) Open	66.7% - 42.0
2) Forested	33.3% - 21.0
Long Corridor	91.0% - 640.0**
1) Open	46.2% - 295.6
2) Forested	53.8% - 344.4

* Acreages based on right-of-way width of 100 ft.
** Acreages based on right-of-way width of 150 ft.

Population of Counties: 1970 Census*

Counties	Total	Population Urban	Rural
Carroll	8523	3884	4639
Owen	7470	--	7470
Henry	10,910	--	10,910
Shelby	18,999	4192	14,817
Franklin	34,481	21,356	13,125

* U.S. Department of Commerce 1971d.

Towns Less Than 1.0 Miles From Line - Distance and Direction

Town	Distance	Direction
Eagle Station	0.5 mi.	East
Moxley	0.2 mi.	East
Perry Park	0.4 mi.	East
Slabtown	0.3 mi.	West
Benson	0.6 mi.	East

Table 2.3-2

Natural Terrain Traversed by the Proposed Transmission Route

River Crossed--(No. of times)
Kentucky River (1)

Perennial Creeks Crossed--by County

County-Creek	Tributary
Carroll County	
Black Rock Creek (4 Branches)	Ohio River
McCool Creek (7 Branches)	Ohio River
Indian Creek	Eagle Creek
Creeks (2)	Eagle Creek
Eagle Creek	Kentucky River
Owen County	
Creeks (2)	Eagle Creek
Buck Run Creek	Eagle Creek
Creeks (2)	Kentucky River
Henry County	
Boiling Branch Creek	Sulphur Creek
Sulphur Creek (4 Branches)	Kentucky River
Sixmile Creek	Kentucky River
Longs Branch Creek	Sixmile Creek
Woodcocks Branch Creek	Sixmile Creek
Little Sixmile Creek	Sixmile Creek
Creek	Sixmile Creek
Shelby County	
East Fork Creek	Sixmile Creek
Scrabble Creek (2 Branches)	Backbone Creek
Backbone Creek (2 Branches)	East Fork Creek
Franklin County	
Goose Creek (2 Branches)	Flat Creek
Quire Creek	Sudduin Branch Creek
Sudduin Branch Creek (2 Branches)	Dutch Fork Creek
Dutch Fork Creek	Benson Creek
Benson Creek	Kentucky River

Table 2.3-3

Cultural Features of the Proposed Transmission Route

Highways Crossed - (No. of times)

Federal	U.S. 227 (1) U.S. 421 (1)
Interstate	Int. 71 (1)
State	Ky. 47 (1) Ky. 36 (1) Ky. 355 (1) Ky. 389 (1) Ky. 22 (1) Ky. 12 (1)

Railroad Crossed - (No. of times)

Louisville-Nashville (2)

Transmission Lines Crossed - (No. of times)

KU 69 kV - Carrollton to Ghent (1)
KU 138 kV - Carrollton to Ghent (1)
KU 138 kV - Carrollton to east of Stedmantown (1)
OVEC 345 kV - Clifty Creek Station (Madison, Indiana) to interconnection point by the Ohio River in Campbell County (1)
EKRECC 69 kV - Renaker to New Castle (1)

Pipeline Crossed - (No. of times)

Mid-Valley Pipeline Co. (Petroleum) - goes through Henry County and the northern part of Owen County (1)

Dedicated Land within 1.0 miles - Distance and Direction

1) Wildlife Preserve - Twin Eagle Wildlife Management Area - 0.2 mi. East
2) Recreation Area - Eagle Station Recreation Area - 0.2 mi. East

Nearby Airport - Distance and Direction

Capital City Airport - 2 mi. East

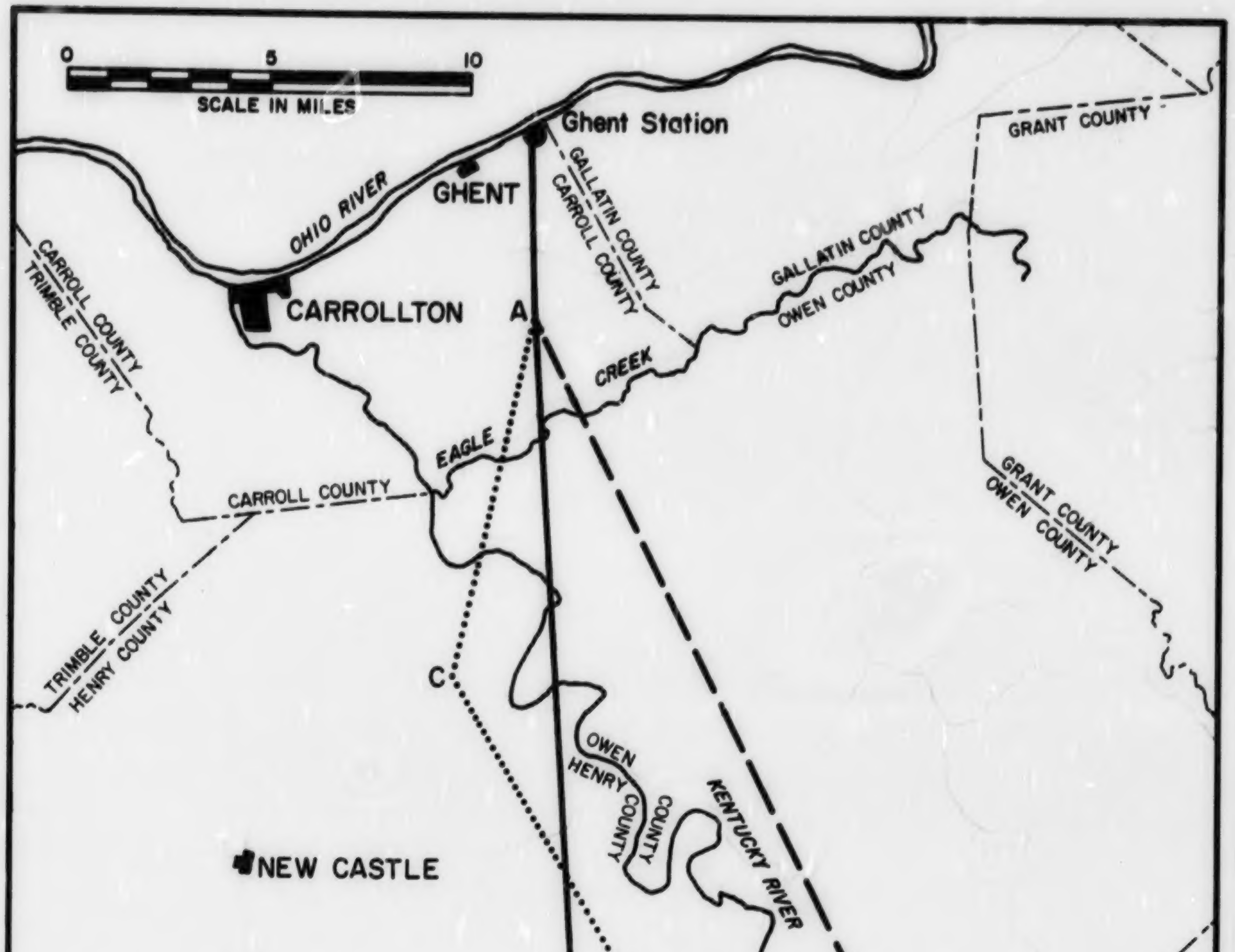

Figure 2.3-4. Railroads and highways crossed by the preferred transmission route.

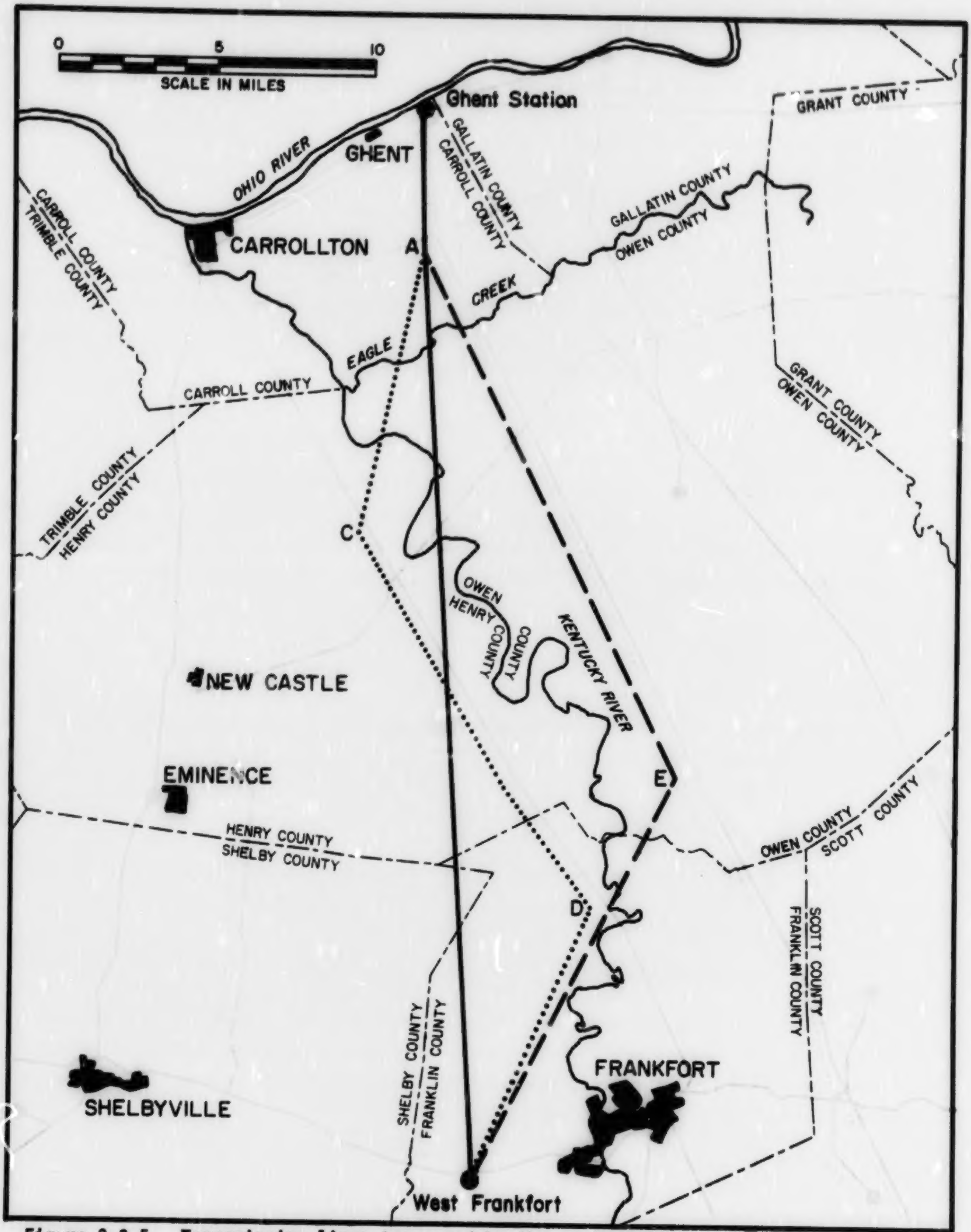

Figure 2.3-5. Transmission lines traversed by the preferred transmission route.

2.3.3 Sensitive Areas Along the Proposed Transmission Route

2.3.3.1 Natural Environment

Backwater Area (T1)

This area is located on the east floodplain of the Kentucky River 3 miles south of Moxley, Kentucky. This area consists of 1 oxbow lake adjacent to the Kentucky River, a small amount of wetland and several artificial impoundments. It is used as both a hunting and fishing area by local residents. The proposed line passes very near the eastern boundary of this area (see Figure 2.3-3).

Wooded Tract (T2)

This area is located 2 miles north of Moxley, Kentucky and very near the Twin Eagle Wildlife Management Area (Kentucky Department of Fish and Wildlife Resources). This tract would be further dissected by the line and would be very near this small wildlife management area operated by the state of Kentucky (see Figure 2.3-3).

Wooded Tract (T3)

This area is located on the western bluff of the Kentucky River 3.5 miles south of Perry Park, Kentucky. This large wooded tract would be further dissected by the proposed line (see Figure 2.3-3).

Limestone Caves

These caves found along the corridors might be inhabited by the Indiana bat, *Myotis sodalis*.

Wet or Marshy Seeps

These areas are situated in wooded tracts, or at the base of hills and ridges, or along rock outcroppings which might contain unusual plants and amphibians. None of these areas have been observed, however, the team did not walk along each of the three lines.

2.3.3.2 Man-Made Environment

Eagle Station Recreation Area (R1)

This area is located on the south bank of Eagle Creek 1 mile west of Eagle Station, Kentucky. This is a parklike area on the floodplain of Eagle Creek. It contains picnic areas, natural oxbow lakes, artificial impoundments, outdoor recreation facilities of several kinds, and some large native trees. It is heavily used by local residents. The preferred route passes very close to the west side of the area and would dissect wooded areas on both the north and south slopes of the Eagle Creek valley (see Figure 2.3-3).

Earthen Mound (OW10)

This mound is located on the east bank of the Kentucky River 0.7 mile southwest of Perry Park, Kentucky. This archaeological site will be dissected by the proposed transmission line (see Figure 2.3-2).

Earthen Mound (OW9)

This mound is located on the east floodplain of the Kentucky River 2 1/4 miles southwest of Perry Park, Kentucky. The proposed line passes within 0.8 mile of this archaeological finding (see Figure 2.3-2).

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Appendix A-1.

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
TAXACEAE	
Canadian Yew *Taxus canadensis* Marsh.	
PINACEAE	
Shortleaf Pine *Pinus echinata* Mill.	
Loblolly Pine *P. taeda*	
Pitch Pine *P. rigida* Mill.	
White Pine *P. strobus* L.	
Virginia Pine *P. virginiana* Mill.	
Eastern Hemlock *Tsuga canadensis* (L.) Carr	
TAXODIACEAE	
Bald Cypress *Taxodium distichum* (L.) Richard	
CUPRESSACEAE	
Red Cedar *Juniperus virginiana* L.	Upland
GRAMINEAE	
Giant Cane *Arundinaria gigantea* (Walt.) Chapm.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
LILIACEAE	
Bristly Greenbrier *Smilax bona-nox* L.	Upland
Sawbrier *S. glauca* Walt.	
Hispid Greenbrier *S. hispida* Muhl.	
Greenbrier *S. rotundifolia* L.	
SALICACEAE	
White Poplar *Populus alba* L.	
Cottonwood *P. deltoides* Marsh	Bottomland
Large-tooth Aspen *P. grandidentata* Michx.	
Swamp Cottonwood *P. heterephylla* L.	
European White Willow *Solix alba* L.	
Peach-leaf Willow *S. amygdaloides* Anders.	
Carolina Willow *S. caroliniana* Michx.	
Pussy Willow *S. discolor* Muhl.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
SALICACEAE (cont'd)	
Crack Willow *S. fragilis* L.	
Upland Willow *S. humilis* Marsh.	
Sandbar Willow *S. interior* Rowlee.	
Black Willow *S. nigra* Marsh	Slope; bottomland
Heart-leaf Willow *S. rigida* Muhl.	
Silky Willow *S. sericea* Marsh.	
Dwarf Upland Willow *S. tristis* Art.	
MYRICACEAE	
Sweetfern *Comptonia peregrina* (L.) Coult.	
JUGLANDACEAE	
Water Hickory *Carya aquatica* (Michx. f.) Nutt.	
Bitternut Hickory *C. cordiformis* (Wang.) K. Koch.	
Pignut *C. glabra* (Mill.) Sweet	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
JUGLANDACEAE (cont'd)	
Pecan *C. illinoensis* (Wang.) K. Kock.	
Big Shagbark Hickory *C. laciniosa* (Michx. f.) Loud.	
Sweet Pignut *C. ovalis* (Wang.) Sarg.	
Shagbark Hickory *C. ovata* (Mill.) K. Koch.	Upland
Pale Hickory *C. pollida* (Ashe.) Engl. and Graebn.	
Mockernut *C. tomentosa* Nuff.	
Butternut *Juglans cinerea* L.	
Black Walnut *J. nigra* L.	Upland
BETULACEAE	
Common Alder *Alnus serrulata* (Aiti.) willd.	
Sweet Birch *Betula lenta* L.	
Yellow Birch *B. lutea* Michx. f.	
River Birch *B. nigra* L.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
BETULACEAE (cont'd)	
American Hornbeam *Carpinus caroliniana* Walt.	
American Hazelnut *Corylus americana* Walt.	
Hophornbeam *Ostrya virginiana* (Mill.) K. Koch.	Upland
FAGACEAE	
American Chestnut *Castanea dentata* (Marsh.) Borkh.	
Chinquapin *C. pumila* (L.) Mill.	
American Beech *Fagus grandifolia* Ehrh.	Upland
White Oak *Quercus alba* L.	
Swamp White Oak *Q. bicolor* Willd.	
Red Oak *Q. borealis* Michx. f.	
Scarlet Oak *Q. coccinea* Muench.	
Southern Red Oak *Q. falcata* Michx.	
Single Oak *Q. imbricana* Michx.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
FAGACEAE (cont'd)	
Overcup Oak *Q. lyrata* Walt.	
Bur Oak *Q. macrocarpa* Michx.	
Blackjack Oak *Q. marilandica* Muench.	
Swamp Chestnut Oak *Q. michauxii* Nutt.	
Chestnut Oak *Q. montana* Willd.	
Chinquapin Oak *Q. muehlenbergii* Engelm.	Upland
Water Oak *Q. nigra* L.	
Pin Oak *Q. palustris* Muench.	Upland
Willow Oak *Q. phellos* L.	
Chinquapin Oak *Q. prinoides* Willd.	
Shumard Oak *Q. shumardii* Buckl.	
Post Oak *Q. stellata* Wang.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
FAGACEAE (cont'd)	
Black Oak *Q. velutina* Lam.	Upland
ULMACEAE	
Sugarberry *Celtis laevigata* Willd.	
Hackberry *C. occidentalis* L.	Upland
Dwarf Hackberry *C. tenuifolia* Nutt.	
Water Elm *Planera aqualica* (Walt.) J. F. Gmel.	
Winged Elm *Ulmus alata* Michx.	
American Elm *U. americana* L.	Upland, bottomland and slope
Slippery Elm *U. rubra* Muhl.	Upland
September Elm *U. serotina* Sarg.	
Rolk Elm *U. thomasi* Sarg.	
MORACEAE	
Paper Mulberry *Broussonelia papyrifera* (L.) Vent.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
MORACEAE (cont'd)	
Osage Orange *Maclura pomifera* (Raf.) Schneid.	
White Mulberry *Morus alba* L.	
Red Mulberry *M. rubra* L.	
SANTALACEAE	
Buffalo-nut *Pyrularia pubera* Michx.	
LORANTHACEAE	
Mistletoe *Phoradendron flavescens* (Pursh.) Nutt.	
ARISTOLOCHINCEAE	
Dutchman's-pipe *Aristolochia durior* Hill.	
Pipe-vine *A. tomentosa* Sims.	
POLYGONACEAE	
Buckwheat Vine *Brunnichia cirrhosa* Gaertn.	
MENISPERMACEAE	
Cupseed *Calycocarpum lyoni* (Pursh) Nutt.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
LAURACEAE (cont'd)	
Sassafras *Sassafras albidum* (Nutt.) Nees.	
SAXIFRAGACEAE	
Wild Hydrangia *Hydrangea arborescens* L.	
Virginia Willow *Itea virginia*	
Mock-orange *Philadelphus hirsutus* Nutt.	
Mock-orange *P. inodorus*	
Prickly Gooseberry *Ribes cynosbati* L.	
Missouri Gooseberry *R. missouriense* Nutt.	
HAMAMELIDACEAE	
Witch-hazel *Hamamelis virginica* L.	
Sweet Gum *Liquidambar styraciflua* L.	
PLATANACEAE	
Sycamore *Platanus occidentalis*	Upland, bottomland and slope

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
MENISPERMACEAE (cont'd)	
Carolina Moonseed *Cocculus carolinus* (L.) D.C.	
Moonseed *Menispermum canadense* L.	
RANUNCULACEAE	
Shrub Yellowroot *Xanthorhiza simplicissima* Marsh.	
MAGNOLIACEAE	
Tulip Tree *Liriodendron tulipifera* L.	Upland
Cucumber Tree *Magnolia acuminata* L.	
Fraser's Magnolia *M. fraseri* Walt.	
Large-leaf Magnolia *M. macrophylla* Michx.	
Umbrella Magnolia *M. tripetala* L.	Upland
ANNONACEAE	
Pawpaw *Asimina triloba* (L.) Dunal.	
LAURACEAE	
Spicebush *Lindera benzoin* (L.) Blume.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ROSACEAE	
Serviceberry *Amelanchier arborea* (Michx.) Fernald.	
Juneberry *A. intermedia* Spach.	
Smooth Serviceberry *A. laevis* Wieg.	
Red Chokeberry *Aronia arbutifolia* (L.) E.H.	
Black Chokeberry *A. melanocarpa* (Michx.) Eli.	
Purple Chokeberry *A. prunifolia* (Marsh.) Rehder.	
Cockspur Thorn *Crataegus crus-gali* L.	
Red Haw *C. mollis* (T. & G.) Scheele.	
Washington Thorn *C. phaenopyrum* L. f.) Medic.	
Ninebark *Physocarpus opulifolius* (L.) Maxim.	
Wild Plum *Prunus americana* Marsh.	Upland
Chickasaw Plum *P. angustifolia* Marsh.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ROSACEAE (cont'd)	
Hortulan Plum *P. hortulana* Bailey.	
Wild Goose Plum *P. munsoniana* Wight and Hedrick.	
Perfumed Cherry *P. mahaleb* L.	
Peach *P. persica* (L.) Batsch.	
Wild Black Cherry *P. serotina* Ehrh.	Upland; slope
Choke Cherry *P. virginiana* L.	
Wild Crab *Pyrus angustifolia* Ait.	
Pear *P. communis* L.	
Wild Crab *P. coronaria* L.	
Prairie Crab *P. ioensis* (Wood.) Bailey.	
Apple *P. malus* L.	
Dog-rose *Rosa canina* L.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ROSACEAE (cont'd)	
Carolina Rose *Rosa carolina* L.	
Sweetbrier *R. eglanteria* L.	
Multiflora Rose *R. multiflora* Thunb.	
Swamp Rose *R. palustris* Marsh.	
Climbing Rose *R. setigera* Michx.	Upland; bottomland
Black Raspberry *Rubus occidentalis* L.	
Flowering Raspberry *R. odoratus* L.	
Southern Dewberry *R. enslenii* TraH.	
Northern Dewberry *R. flagellaris* Willd.	
Swamp Dewberry *R. hispidus* L.	
Blackberry *R. allegheniensis* Porter.	Upland; bottomland
Meadowsweet *Spiraea alba* DuRoi.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ROSACEAE	
Japanese Spiraea *S. japonica* L.	
Steeplebush *S. tomentosa* L.	
LEGUMINOSAE	
Indigo Bush *Amorpha fruticosa* L.	
Redbud *Cercis canadensis* L.	
Yellow-wood *Cladrastris lufea* (Michx. f.) K. Koch.	
Water Locust *Gleditsia aquatica* Marsh.	
Honey Locust *G. triacanthos* L.	Upland; bottomland
Kentucky Coffee-tree *Gymnocladus dioica* (L.) K. Koch.	Upland
Rosa-acacin *Robinia hispida* L.	
Black Locust *R. pseudo-acacia* L.	Upland, bottomland and slope
Wisteria *Wisteria macrostachya* Nutt.	
RUTACEAE	
Hop-tree *Ptelea trifoliata* L.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
RUTACEAE (cont'd)	
Prickly Ash *Xanthoxylum americanum* Mill.	
SIMAROUBACEAE	
Tree-of-Heaven *Ailanthus altissima* (Mill.) Swingle.	
ANACARDIACEAE	
Fragrant Sumac *Rhus aromatica* Ait.	
Winged Sumac *R. copallina* L.	Upland
Smooth Sumac *R. glabra* L.	
Poison Ivy *R. radicans* L.	
Poison Oak *R. toxicodendron* L.	
Staghorn Sumac *R. typhina* L.	
AQUIFOLIACEAE	
Swamp Holly *Ilex decidua* Walt.	
Mountain Winterberry *I. montana* T. & G.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
AQUIFOLIACEAE (cont'd)	
American Holly *I. opaca* Ait.	
Winterberry *I. verticillata* (L.) Gray.	
CELASTRACEAE	
Bittersweet *Celastrus scandens* L.	
Strawberry-bush *Euonymus americanus* L.	
Wahoo *E. atropurpureas* Jacq.	
Winter Creeper *E. fortunei* (Turez.) Hand.-Mazz.	
Running Strawberry-bush *E. obovatus* Nutt.	
Pachistima *Pachistima canbyi* Gray	
STAPHYEACEAE	
Bladdernut *Staphylea trifolia* L.	
ACERACEAE	
Box Elder *Acer negundo* L.	Upland

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ACERACEAE (cont'd)	
Black Maple *A. nigrum* Michx f.	
Striped Maple *A. pensylvanicum* L.	
Red Maple *A. rubrum* L.	Slope
Silver Maple *A. saccharinum* L.	Slope
Sugar Maple *A. saccharum* Marsh.	Upland
Mountain Maple *A. spicatum* Lam.	Slope
HIPPOCASTANACEAE	
Red-and-Yellow Buckeye *Aesculus discolor* Pursh.	
Ohio Buckeye *A. glabra* Willd.	Upland
Yellow Bucheye *A. octandra* Marsh.	
Red Buckeye *A. pavia* L.	
RHAMNACEAE	
Supple-jack *Berchemia scandens* (Hill.) K. Koch.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
RHAMNACEAE (cont'd)	
New Jersey Tea *Ceanothus americanus* L.	
Carolina Buckthorn *Rhamnus caroliniana* Walt.	
Lance-leaf Buckthorn *R. lanceolata* Pursh.	
VITACEAE	
Pepper-vine *Ampelopsis arborea* (L.) Koehne.	
Heart-leaf Ampelopsis *A. cordata* Michx.	
Virginia Creeper *Parthenocissus quinquefolia* (L.) Planch.	
Summer Grape *Vitis aestivalis* Michx.	
Bailey's Grape *V. baileyana* Munson	
Graybark Grape *V. cinerea* Engelm.	
Fox Grape *V. labrusea* L.	
Catbird Grape *V. palmata* Vahl.	
Riverbank Grape *V. riparia* Michx.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
VITACEAE (cont'd)	
Muscadine *V. rotoundifolia* Michx.	
Frost Grape *V. vulpina* L.	
TILIACEAE	
American Linden *Tilia americana* L.	Upland; slope
Linden *T. floridana* (V. Engler) Small.	
White Basswood *T. heterophylla* Vent.	
Basswood *T. neglecta* Spach.	
THEACEAE	
Mountain Camellia *Stewartia ovata* (Cav.) Weatherby.	
HYPERICACEAE	
Bushy St. John's-wort *Hypericum densiflorum* Pursh.	
Golden St. John's-wort *H. frondosum* Michx.	
Shrubby St. John's-wort *H. spathulatum* (Spach.) Stend.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
THYMELAEACEAE	
Leatherwood *Dirca palustris* L.	
LYTHRACEAE	
Swamp Loosestripe *Decodon verticillatus* (L.) Eli.	
NYSSACEAE	
Tupelo Gum *Nyssa aquatica* L.	
Black Gum *N. sylvatica* Marsh.	
ARALIACEAE	
Hercule's-club *Aralia spinosa* L.	
English Ivy *Hedera helix* L.	
CORNACEAE	
Flowering Dogwood *Cornus florida* L.	Upland
Alternate-leaf Dogwood *C. alternifolia* L. f.	
Silky Dogwood *C. amomum* Mill.	
Rough-leaf Dogwood *C. drummondi* Meyer	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
CORNACEAE (cont'd)	
Stiff Dogwood *Cornus foemina* Mill.	
Pale Dogwood *C. obliqua* Raf.	
Gray Dogwood *C. racemosa* Lam.	
Red Osier *C. stolonifera* Michx.	
CLETHRACEAE	
Mountain Pepperbush *Clethra acuminata* Michx.	
ERICACEAE	
Trailing Arbutus *Epigaea repens* L.	
Huckleberry *Gaylussacia baccata* (Wang.) K. Koch.	
Box-huckleberry *G. brachycera* (Michx.) Gray	
Mountain Laurel *Kalmia latifolia* L.	
Privet-and Romeda *Lyonia ligustrina* (L.) D. C.	
Sourwood *Oxydendrum arboreum* (L.) D. C.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ERICACEAE (cont'd)	
Smooth Azalea *Rhododendron arborescens* (Pursh.) Torr.	
Mountain Rosebay *R. catawbiense* Michx.	
Flame Azalea *R. calendulaceum* (Michx.) Torr.	
Red Azalea *R. cumberlandense* E. L. Braun.	
Great Laurel *R. maximum* L.	
Pinxter-flower *R. nudiflorum* (L.) Torr.	
Rose Azalea *R. roseum* (Loisel.) Rehder.	
Clammy Azalea *R. viscosum* (L.) Torr.	
Mountain Dryland Blueberry *Vaccinium alto-montanum* Ashe.	
Farkleberry *V. arboreum* Marsh.	
Constabel's Highbush Blueberry *V. constablaei* Gray	
Lowbush Blueberry *V. pallidum* Ait.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
OLEACEAE (cont'd)	
Upland Forestiera *Forestiera ligustrina* (Michx.) Poir.	
White Ash *Fraxinus americana* L.	Upland; slope
Biltmore Ash *F. americana var. biltmoreana* (Beadle) J. Wright	
Red Ash *F. pennsylvanica var. subintegerrima* (Vahl.) Fernald	
Blue Ash *F. quadrangulata* Michx.	
Pumpkin Ash *F. tomentosa* Michx. f.	
Privet *Ligustrum* spp.	
APOCYNACEAE	
Climbing Dogbane *Trachelospermum difforme* (Walt.) Gray.	
BIGNONIACEAE	
Cross-vine *Bignonia caperolata* L.	
Trumpet-vine *Campsis radicans* (L.) Seem.	
Southern Catalpa *Catalpa bignonioides* Walt.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
ERICACEAE (cont'd)	
Highbush Blueberry *Vaccinium simulatum* Small.	
Beerberry *V. stamineum* L.	
Lowbush Blueberry *V. vacillans* Torr.	
SAPOTACEAE	
Buckthorn Bumelia *Bumelia lycioides* (L.) Gaertn.	
EBENACEAE	
Persimmon *Diospyros virginiana* L.	
STYRACACEAE	
Silverbell *Halesia carolina* L.	
Snowbell *Styrax americana* Lam.	
Large-leaf Snowbell *S. grandifolia* Ait.	
OLEACEAE	
Fringe-tree *Chionanthus virginicus* L.	
Swamp Privet *Forestiera acuminata* (Michx.) Poir.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
OLEACEAE (cont'd)	
Upland Forestiera *Forestiera ligustrina* (Michx.) Poir.	
White Ash *Fraxinus americana* L.	Upland; slope
Biltmore Ash *F. americana var. biltmoreana* (Beadle) J. Wright	
Red Ash *F. pennsylvanica var. subintegerrima* (Vahl.) Fernald	
Blue Ash *F. quadrangulata* Michx.	
Pumpkin Ash *F. tomentosa* Michx. f.	
Privet *Ligustrum* spp.	
APOCYNACEAE	
Climbing Dogbane *Trachelospermum difforme* (Walt.) Gray.	
BIGNONIACEAE	
Cross-vine *Bignonia caperolata* L.	
Trumpet-vine *Campsis radicans* (L.) Seem.	
Southern Catalpa *Catalpa bignonioides* Walt.	

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
BIGNONIACEAE (cont'd)	
Northern Catalpa *C. speciosa* Warder.	
Royal Paulonia *Paulownia tomentosa* (Thunb.) Steud.	
RUBIACEAE	
Buttonbush *Cephalanthus occidentalis* L.	
CAPRIFOLIACEAE	
Wild Honeysuckle *Lonicera dioica* L.	
Yellow Honeysuckle *L. flavida* Cockerell.	
Japanese Honeysuckle *L. japonica* Thunb.	Bottomland; slope
Wild Honeysuckle *L. prolifera* (Kirchn.) Rehd.	
Trumpet Honeysuckle *L. sempervirens* L.	
Elderberry *Sambucus canadensis* L.	Bottomland
Red-berried Elder *S. pubens* Michx.	
Buckberry *Symphoricarpos orbiculatus* Moench.	Upland; bottomland

Appendix A-1. (cont'd)

Vascular plant species probably occurring at the Ghent Power Station. Those encountered are indicated by habitat (e.g., upland, bottomland, slope).

TAXA	Habitat
CAPRIFOLIACEAE (cont'd)	
Maple-leaf Viburnum *Viburnum acerifolium* L.	
Withe-rod *V. cassinoides* L.	
Arrow-wood *V. dentatum* L.	
Nannyberry *V. lentago* L.	
Kentucky Viburnum *V. molle* Michx.	
Possum-haw *V. nudum* L.	
Black-haw *V. prunifolium* L.	
Arrow-wood *V. rafinesquianum* Schult.	
Arrow-wood *V. recognitum* Fern.	
Southern Black-haw *V. rufidulum* Raf.	

Appendix A-2.

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: AMPHIBIA	
CRYPTOBRANCHIDAE	
Hellbender *Cryptobranchus alleganiensis*	Protected areas of rivers and streams.
Mudpuppy *Necturus maculosa*	Ponds, lakes, streams, and rivers.
AMBYSTOMATIDAE	
Small-mouthed Salamander* *Ambystoma texanum*	Debris in ponds, swamps, and lakes.
Tiger Salamander *A. tigrinum*	Moist environments.
Jefferson Salamander *A. jeffersonianum*	Damp areas under rocks, logs, and boards.
Spotted Salamander *A. maculatum*	Wet and moist localities.
Marbled Salamander *A. opacum*	Moist sandy areas; occasionally on dry sites.
SALAMANDRIDAE	
Red-spotted Newt *Notopthalmus viridescens*	Permanent and semi-permanent bodies of water in early stages; later seen occasionally on land.

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* Encountered during site visit.

Appendix A-2. (cont'd)

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: AMPHIBIA (cont'd)	
PLETHODONTIDAE	
Dusky Salamander *Desmognathus fuscus*	Streams, creeks, and ponds.
Slimy Salamander *Plethodon glutinosis*	Moist forested areas.
Ravine Salamander *P. richmondi*	Wooded slopes of hills and valleys.
Zigzag Salamander *P. dorsalis*	Most often found in rockpiles or near caves.
Red-backed Salamander *P. cinereus*	Wooded localities.
Four-toed Salamander *Hemidactylium scutatum*	Boggy areas with sphagum moss.
Red Salamander *Pseudotriton ruber*	Under organic debris in or near clear running streams.
Mud Salamander *P. montanus*	Muddy areas of streams and ponds.
Two-lined Salamander *Eurycea bislineata*	Swift-moving, clear springs and streams.
Cave Salamander *E. lucifuga*	Semi-light areas of caves and under debris in forests.
Long-tailed Salamander *E. longicauda*	Caves, streams, and springs.

Appendix A-2. (cont'd)

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: AMPHIBIA (cont'd)	
PELOBATIDAE	
Eastern Spadefoot *Scaphiopus holbrooki*	Forested sites with friable soils.
BUFONIDAE	
American Toad *Bufo americanus*	Most moist habitats.
Woodhouse's Toad *B. woodhousei*	Mesic and xeric locales including swamps, grasslands, and mountains.
HYLIDAE	
Spring Peeper *Hyla crucifer*	Near streams, creeks, and ponds in forests.
Gray Treefrog *H. versicolor* and *H. chrysoscelis*[1]	Moist wooded areas.
Chorus Frog *Pseudacris triseriata*	Grasslands and farmlands.
Cricket Frog *Acris crepitans*	Edges of ponds, lakes, and intermittent streams.
RANIDAE	
Green Frog *Rana clamitans*	Creeks, ponds, streams.

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[1] Closely related species separable only by voice in the field. For this reason the exact range of each species is not known.

Appendix A-2. (cont'd)

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: AMPHIBIA (cont'd)	
RANIDAE (cont'd)	
Bullfrog *Rana catesbeiana*	Larger bodies of water including lakes, ponds, slow-moving streams.
Northern Leopard Frog *R. pipiens*	Shallow-water habitats.
Southern Leopard Frog *R. utricularia*	Ponds, cattle tanks, intermittent streams.
Pickerel Frog *R. palustris*	Swamps, streams, ravines.
Wood Frog *R. sylvatica*	Wet or moist forested areas.
CLASS: REPTILIA	
CHELYDRIDAE	
Snapping Turtle *Chelydra serpentina*	Lakes and ponds.
Stinkpot *Sternotherus odoratus*	Clear lakes, ponds and rivers.
TESTUDINIDAE	
Eastern Box Turtle *Terrapene carolina*	Sandy terrestrial sites.

Appendix A-2. (cont'd)

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: REPTILIA (cont'd)	
TESTUDINIDAE (cont'd)	
Painted Turtle *Chrysemys picta*	Marshes, ponds, swamps, drainage ditches.
Map Turtle *Graptemys geographica*	Lakes and rivers.
CHELONIIDAE	
Smooth Softshell *Trionyx muticus*	Creeks, streams, rivers, occasionally lakes.
Spiny Softshell *T. spiniferus*	Rivers and ponds.
IGUANIDAE	
Fence Lizard *Sceloporus undulatus*	Rocky and sandy areas of prairies, brushlands, and forests.
SCINCIDAE	
Five-lined Skink *Eumeces fasciatus*	Organic debris and rock piles near forests.
Broad-headed Skink *E. laticeps*	Swamps, forests, and brushlands.
COLUBRIDAE	
Northern Water Snake *Natrix sipedon*	Marshes, swamps, ponds, creeks, and lakes.

Appendix A-2. (cont'd)

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: REPTILIA (cont'd)	
COLUBRIDAE (cont'd)	
Queen Snake *Natrix septembittata*	Rivers, streams, and other aquatic habitats.
Red-bellied Snake *Storeria occipitomaculata*	Open forests.
Brown Snake *S. dekayi*	Marshes, swamps, and upland woods.
Garter Snake* *Thamnophis sirtalis*	Meadows, swamps, grasslands, and woodlands.
Ribbon Snake *T. sauritus*	Vegetated edges of swamps, sloughs, creeks.
Eastern Hognose Snake *Heterodon platyrhinos*	Open, sandy areas.
Ringneck Snake *Diadophis punctatus*	Rocks and logs in wooded habitats.
Worm Snake *Carphophis amoenus*	Moist protected sites in forests.
Racer *Coluber constrictor*	Forest and brush edge habitats and grasslands.
Rough Green Snake *Opheodrys aestivus*	Dense woody undergrowth of forests.
Black Rat Snake *Elaphe obsoleta*	Variety of areas from farmlands to woodlands.

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* Encountered during site visit.

Appendix A-2. (cont'd)

Possible occurrence and habitat preference of amphibians and reptiles at the Ghent Power Station area (after Barbour 1956; Blair et al. 1968; Conant 1975; Stebbins 1954).

TAXA	Preferred Habitat
CLASS: REPTILIA (cont'd)	
COLUBRIDAE (cont'd)	
Milk Snake *Lampropeltis triangulum*	Grasslands and cultivated fields.
Prairie Kingsnake *L. calligaster*	Open woods, savannahs, prairie, and pastures.
Black Kingsnake *L. getulus*	Most habitats but more common near creeks and streams.
Scarlet Snake *Cemophora coccinea*	Sandy or loam soils under boards, logs, and rocks.
VIPERIDAE	
Copperhead *Agkistrodon contortrix*	Wood piles and rocky hillsides.
Timber Rattlesnake *Crotalus horridus*	Timbered areas.

Appendix A-3.

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
GAVIIDAE					
Common Loon *Gavia immer*	R	UC	C	FC	Open water.
PODICIPEDIDAE					
Red-necked Grebe *Podiceps grisegena*	R	R			Large bodies of water.
Horned Grebe *P. auritus*	R	R		R	Lakes, rivers.
Pied-billed Grebe *Polilymbus podiceps*	R	C	FC	C	Emergent vegetation of marshes, sloughs, rivers.
PELECANIDAE					
White Pelican *Pelecanus erythrorhynchos*	VR		VR		Large lakes, reservoirs.
PHALACROCORACIDAE					
Double-crested Cormorant *Phalacrocorax auritus*	R	FC	FC	FC	Swamps, lakes, large rivers.
ANHINGIDAE					
Anhinga *Anhinga anhinga*			R		Swamps and woody lake margins.
ARDEIDAE					
Great Blue Heron *Ardea herodias*	R	C	C	C	Borders of streams, ponds, and creeks.

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[1] VR=very rare, R=rare, UC=uncommon, FC=fairly common, C=common, A=abundant (after Barbour et al. 1973).

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
ARDEIDAE (cont'd)					
Green Heron *Butorides virescens*	R	C	C	C	Marshes, swamps, reservoirs, farm ponds.
Little Blue Heron *Florida caerulea*		R	UC	R	Shallow-water habitats.
Cattle Egret *Bubulcus ibis*		R	R	R	Pastures, grasslands, ponds, and marshes.
Common Egret *Casmerodius albus*		R	FC	R	Ponds, streams, sloughs.
Snowy Egret *Leucophoyx thula*		FC	C	R	Shallow areas of marshes, creeks, and reservoirs.
Black-crowned Night Heron *Nycticorax nycticorax*		FC	R	FC	Large marshes, occasionall in lakes, streams, ponds.
Yellow-crowned Night Heron *Nyctanassa violacea*		R	FC	R	Woods and swamps.
Least Bittern *Ixobrychus exilis*		R	UC	R	Emergent vegetation of marshes, swamps, lakes.
American Bittern *Botaurus lentiginosus*		FC		UC	Tall reeds of marshes and swamps.
CICONIIDAE					
Wood Stork *Mycteria americana*			FC		Swamps, creeks, and other wet areas.
THRESKIORNITHIDAE					
Glossy Ibis *Plegadis falcinellus*		R			Mudflats and shallow-water habitats.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	 Sp	 Su	 F	Preferred Habitat
ANATIDAE					
Whistling Swan *Olor columbianus*	VR	VR		VR	Large impoundments, lakes, and ponds.
Canada Goose *Branta canadensis*	FC	FC	R	FC	Marshes, lakes, prairies, and cultivated lands.
Snow Goose *Chen caerulescens*		FC		C	Large rivers, lakes, and grasslands.
Mallard* *Anas platyrhynchos*	A	A	R	A	Shallow areas of ponds, lakes, and streams.
Black Duck *A. rubripes*	C	C	VR	C	Lakes, ponds, streams, creeks.
Gadwall *A. strepera*	VR	R		R	Ponds, flooded fields, shallow water areas.
Pintail *A. acuta*	UC	C		FC	Lakes, rivers, ponds, and creeks.
Green-winged Teal *A. carolinensis*	VR	UC		UC	Marshes, sloughs, farm tanks.
Blue-winged Teal *A. discors*		C	R	C	Swamps, lakes, ponds.
American Widgeon *Mareca americana*	R	A		VC	Lakes, large rivers, and shallow ponds.
Shoveler *Spatula clypeata*		C		R	Marshes, impoundments, sewage ponds, large rivers.
Wood Duck* *Aix sponsa*	R	UC	C	UC	Swamps, marshes, and streams adjacent to woodlands.
Redhead *Aythya americana*	UC	R		R	Large rivers and lakes.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
ANATIDAE (cont'd)					
Ring-necked Duck *Aythya collaris*	UC	C		C	Tree-lined ponds, swamps, and lakes.
Canvasback *A. valisineria*	R	C		C	Large rivers and lakes.
Greater Scaup *A. marila*	R	R		R	Large rivers and lakes.
Lesser Scaup *A. affinis*	C	A		A	Ponds, creeks sloughs, farm tanks, and lake backwater.
Common Goldeneye *Bucephala clangula*	C	UC		UC	Edges of large lakes, rivers.
Bufflehead *B. albeola*	FC	UC		UC	Reservoirs, ponds, and lakes.
Oldsquaw *Clangula hyemalis*	R	R		R	Impoundments, rivers, and lakes.
White-winged Scoter *Melanitta deglandi*	R	R		R	Lakes and other large bodies of water.
Ruddy Duck *Oxyura jamaicensis*	R	UC	VR	C	Creeks, ponds, and sloughs.
Hooded Merganser *Lophodytes cucullatus*	FC	FC	R	FC	Rivers, ponds, swamps, and wet bottomlands.
Common Merganser *Mergus merganser*	A	C		C	Lakes and large rivers.
Red-breasted Merganser *M. serrator*	R	FC		R	Ponds, sloughs, creeks, and streams.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	 Sp	 Su	 F	Preferred Habitat
CATHARTIDAE					
Turkey Vulture *Cathartes aura*	FC	FC	C	FC	Most areas.
Black Vulture *Coragyps atratus*	FC	FC	FC	FC	Most areas.
ACCIPITRIDAE					
Mississippi Kite *Ictinia misisippiensis*					
Sharp-shinned Hawk *Accipiter striatus*	R	UC	R	UC	Woods, woodland edges.
Cooper's Hawk *A. cooperi*	FC	FC	FC	FC	Woods, woodland edges.
Rad-tailed Hawk* *Buteo jamaicensis*	C	C	FC	C	Grasslands and forests.
Red-shouldered Hawk *B. lineatus*	C	C	C	C	Riparian and lowland forests.
Broad-winged Hawk *B. platypterus*		UC	FC	UC	Upland hardwood stands.
Rough-legged Hawk *B. lagopus*	VR	VR		VR	Grasslands, pastures, farmland.
Golden Eagle *Aguila chrysaetos*	VR				Edges of large lakes and reservoirs.
Bald Eagle *Haliaeetus leucocephalus*	FC	R	VR	R	Edges of large lakes and reservoirs.
Marsh Hawk *Circus cyaneus*	FC	FC	VR	FC	Marshes, grasslands, and brushlands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
PANDIONIDAE					
Osprey *Pandion haliaetus*		FC		FC	Lakes, large rivers, and impoundments.
FALCONIDAE					
Pigeon Hawk *Falco columbarius*		R		R	Grasslands, woodland openings.
Sparrow Hawk* *F. sparverius*	C	C	C	C	Prairies, pastures, and farmlands.
TETRAONIDAE					
Ruffed Grouse* *Bonasa umbellus*	FC	FC	FC	FC	Woodland habitats.
PHASIANIDAE					
Bobwhite *Colinus virginianus*	C	C	C	C	Brushland edges, weedy grasslands, and hedges
MELEAGRIDIDAE					
Wild Turkey *Meleagris gallopavo*	FC	FC	FC	FC	Ecotonal areas between woodlands and small openings.
GRUIDAE					
Sandhill Crane *Grus canadensis*		R		R	Open grasslands, shallow marshes.
RALLIDAE					
King Rail *Rallus elegans*		R	UC	R	Weedy margins of marshes, sloughs, and streams.
Virginia Rail *R. limicola*		R		R	Densely vegetated marshes.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
RALLIDAE (cont'd)					
Sora *Porzana carolina*		FC		FC	Vegetation of marshes, streams, creeks.
Common Gallinule *Gallinula chloropus*		R	VR	R	Water adjoining emergent vegetation.
American Coot *Fulica americana*	R	A	VR	A	Shallow areas of lakes and ponds.
CHARADRIIDAE					
Semipalmated Plover *Charadrius semipalmatus*		FC		FC	Mudflats, sloughs, and sandbars.
Piping Plover *C. melodus*		R		R	Marshes, mudflats, and pond edges.
Killdeer* *C. vociferus*	FC	C	C	C	Pastures, farmland, and mudflats.
American Golden Plover *Pluvialis dominica*		R		R	Pastures, moist bottomland, and marshes.
Black-bellied Plover *Squatarola squatarola*		R		R	Pasture, pond edges.
Ruddy Turnstone *Arenaria interpres*				R	Wet rocks and sandbars adjacent to streams.
SCOLOPACIDAE					
American Woodcock *Philohela minor*	VR	C		C	Wooded seeps and sloughs.
Common Snipe *Capella gallinago*		C		FC	Marshes, mudflats, and creek edges.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	 Sp	 Su	 F	Preferred Habitat
SCOLOPACIDAE (cont'd)					
Upland Plover *Bartramia longicauda*		UC		UC	Pastures and grasslands.
Spotted Sandpiper *Actitis macularia*		C	R	C	Borders of creeks and streams.
Solitary Sandpiper *Tringa solitaria*		C	VR	C	Shores of lakes, rivers, and creeks.
Willet *Catoptrophorus semipalmatus*		VR		VR	Lake and reservoir borders.
Greater Yellowlegs *Totanus melanoleucus*		FC	VR	FC	Mudflats, marshes, margins of lakes.
Lesser Yellowlegs *T. flavipes*		C	VR	C	Mudflats, marshes, margins of lakes.
Knot *Calidris canutus*		VR		VR	Sandbars, borders of rivers.
Pectoral Sandpiper *Erolia melanotos*		C		C	Wet pastures, grassy areas, mudflats.
White-rumped Sandpiper *E. fuscicollis*		R		R	Rocky edges of fast-flowing streams.
Baird's Sandpiper *E. bairdii*		R		R	Mudflats and marshes.
Least Sandpiper *E. minutilla*		FC		FC	Muddy and grassy borders of lakes and rivers.
Dunlin *E. alpina*		R		R	Mudflats and sandy borders of lakes and rivers.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
SCOLOPACIDAE (cont'd)					
Short-billed Dowitcher *Limnodromus griseus*		R		UC	Shallow water of ponds, creeks, and reservoirs.
Stilt Sandpiper *Micropalama himantopus*		VR		UC	Mudflats, sandbars, and marshes.
Semipalmated Sandpiper *Ereuhetes pusillus*		UC		FC	Muddy and sandy edges of rivers, lakes, streams.
Western Sandpiper *E. mauri*		UC		UC	Muddy and sandy edges of rivers, lakes, streams.
Buff-breasted Sandpiper *Tryngites subruficollis*		R		R	Grasslands and the borders of impoundments, lakes, and rivers.
Sanderling *Crocethia alba*		R		R	Sandbars and marshes.
RECURVIROSTRIDAE					
American Avocet *Recurvirostra americana*				R	Emergent vegetation lining streams and creeks.
PHALAROPODIDAE					
Wilson's Pharalope *Steganopus tricolor*		R		R	Open water of lakes and ponds.
LARIDAE					
Herring Gull *Larus argentatus*	A	R		R	Large rivers, lakes and reservoirs.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
LARIDAE (cont'd)					
Ring-billed Gull *L. delawarensis*	C	C		C	Rivers, lakes and reservoirs.
Franklin's Gull *L. pipixcan*		R		R	Aquatic habitats.
Forsters Tern *Sterna forsteri*		C		C	Rivers, creeks, lakes, and impoundments.
Least Tern *S. albifrons*			UC	VR	Sloughs, rivers, lakes.
Caspian Tern *Hydroprogne caspia*		VR		R	Oxbows, ponds, reservoirs.
Black Tern *Chlidonias niger*		FC		C	Marshes, ponds, small lakes.
COLUMBIDAE					
Rock Dove *Columba livia*	A	A	A	A	Buildings and grain elevators.
Mourning Dove *Zenaida macroura*	A	A	A	A	Pastures, farmlands, brushlands, and forests.
CUCULIDAE					
Yellow-billed Cuckoo *Coccyzus americanus*		FC	UC	FC	Woodlands and swamps.
Black-billed Cuckoo *C. erythropthalmus*		FC	UC	FC	Forested uplands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
TYTONIDAE					
Barn Owl *Tyto alba*	UC	UC	UC	UC	Abandoned buildings near grasslands.
STRIGIDAE					
Screech Owl *Otus asio*	UC	UC	UC	UC	Woodlands of all types, occasionally in buildings.
Great Horned Owl *Bubo virginianus*	FC	FC	FC	FC	Thickly forested areas.
Barred Owl *Strix varia*					Bottomland forests and swamps.
Short-eared Owl *Asio flammeus*	UC	R		R	Grasslands and farmlands.
Saw-whet Owl *Aegolius acadicus*	R				Moist coniferous forests.
CAPRIMULGIDAE					
Chuck-wills Widow *Caprimulgus carolinensis*		UC	C	UC	Open, upland forests and woodland edges.
Common Nighthawk *Chordeiles minor*		UC	C	UC	Cities, farmland, and pastures.
APODIDAE					
Chimney Swift *Chaetura pelagica*		UC	C	UC	Open areas and towns.
TROCHILIDAE					
Ruby-throated Hummingbird *Archilochus colubris*		UC	C	UC	Woodlands, farmland, and residences.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
ALCEDINIDAE					
Belted Kingfisher *Megaceryle alcyon*	C	C	C	C	Lakes, rivers, streams, and ponds.
PICIDAE					
Yellow-shafted Flicker* *Colaptes auratus*	C	C	C	C	Open forests, towns, and farms.
Pileated Woodpecker* *Cryocopus pileatus*	C	C	C	C	Mature woodlands.
Red-bellied Woodpecker* *Centurus carolinus*	C	C	C	C	Farmland, open woodlands.
Red-headed Woodpecker *Melanerpes erythrocephalus*	FC	FC	FC	FC	Sparsely wooded habitats, and forest margins.
Yellow-bellied Sapsucker* *Sphyrapicus varius*	C	C		C	Open broadleafed forests.
Hairy Woodpecker *Dendrocopus villosus*	C	C	C	C	Large wooded areas.
Downy Woodpecker *D. pubescens*	C	C	C	C	Forests of all types.
Red-cockaded Woodpecker *D. borealis*	FC	FC	FC	FC	Mature pine-oak communities.
TYRANNIDAE					
Eastern Kingbird *Tyrannus tyrannus*		UC	C	UC	Savannah-type habitats and grasslands.
Great-crested Flycatcher *Myiarchus crinitus*		UC	C	UC	Open woodlands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
TYRANNIDAE (cont'd)					
Eastern Phoebe* *Sayornis phoebe*	R	UC	C	UC	Wooded and unwooded moist bottomlands.
Yellow-bellied Flycatcher *Empidonax flaviventris*		R		FC	Brushlands and forest habitats.
Acadian Flycatcher *E. virescens*		UC	C	UC	Wet forest bottomlands.
Traill's Flycatcher *E. traillii*		R		R	Scrub areas and brushy sloughs.
Least Flycatcher *E. minimus*		C		C	Open woodlands and forest edges.
Eastern Wood Peewee *Contopus virens*		UC	C	UC	Forested areas.
Olive-sided Flycatcher *Nuttallornis borealis*		R		R	Savannah habitats.
ALAUDIDAE					
Horned Lark *Eremophila alpestris*	C	C	C	C	Roadsides, farmlands, and pastures.
HIRUNDIDAE					
Tree Swallow *Iridoprocne bicolor*		C		UC	Lakes, ponds, and rivers.
Bank Swallow *Riparia riparia*		FC	UC	FC	Mud banks of streams and rivers.
Rough-winged Swallow *Stelgidopteryx ruficollis*		UC	C	UC	Open habitat usually adjacent to a cliff or bute.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
HIRUNDIDAE (cont'd)					
Barn Swallow *Hirundo rustica*		UC	C	UC	Farmlands, pastures, ponds and lakes.
Cliff Swallow *Petrochelidon pyrrhonota*		UC	R	UC	Reservoirs, lakes, dams, and bridges.
Purple Martin *Progne subis*		UC	FC	UC	Open habitats.
CORVIDAE					
Blue Jay* *Cyanocitta cristata*	C	C	C	C	City dwellings, and woodlands.
Common Crow* *Corvus brachyrhynchos*	A	C	C	C	Farmland and open forests.
Fish Crow *C. ossifragus*			UC		Woody borders of lakes and rivers.
PARIDAE					
Carolina Chickadee* *Parus carolinensis*	C	C	C	C	Forests of all types.
Tufted Titmouse* *P. bicolor*	C	C	C	C	Most bottomlands except the densest forests.
SITTIDAE					
White-breasted Nuthatch *Sitta carolinensis*	FC	FC	FC	FC	Swamps, and upland woodlands.
Red-breasted Nuthatch *S. canadensis*	FC	C		C	Most common in pine-oak forests.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
CERTHIIDAE					
Brown Creeper *Certhis familiaris*	FC	C		C	Mature bottomland forests near streams.
TROGLODYTIDAE					
House Wren *Troglodytes aedon*		UC	C	UC	Residential areas and farmlands.
Winter Wren *T. troglodytes*	FC	FC		FC	Brush and tangled undergrowth of bottomland forests.
Bewick's Wren *Thryomanes bewickii*	UC	UC	C	UC	Brushy and open wooded habitats.
Carolina Wren* *Thryothorus ludovicianus*	C	C	C	C	Swamps and woodlands.
Long-billed Marsh Wren *Telmatodytes palustris*		VR		R	Wet grasslands and emergent marsh vegetation.
Short-billed Marsh Wren *Cistothorus platensis*		UC	UC	UV	Wet grasslands and emergent marsh vegetation.
MIMIDAE					
Mockingbird* *Mimus polyglottos*	C	C	C	C	Suburban areas, and open forested habitat.
Catbird *Dumetella carolinensis*		UC	C	UC	Dense brushlands.
Brown Thrasher *Toxostoma rufum*	R	UC	C	UC	Overgrown fields, forest margins, and shrublands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
TURDIDAE					
Robin* *Turdus migratorius*	C	FC	VC	FC	Savannahs, open brushlands, grasslands, residential areas.
Wood Thrush *Hylocichla mustelina*		UC	C	UC	Forests of all types.
Swainson's Thrush *H. ustulata*		C		FC	Forests of all types.
Gray-cheeked Thrush *H. minima*		FC		FC	Dense brushlands.
Veery *H. fuscescens*		FC	C	FC	Forest margins and open brushlands.
Eastern Bluebird* *Sialia sialis*	C	C	C	C	Grasslands, savannahs, and forest openings.
SYLVIIDAE					
Blue-gray Gnatcatcher *Polioptila caerulea*		UC	C	UC	Open woodlands and forest margins.
Golden-crowned Kinglet *Regulus satrapa*	C	C		C	Evergreen forests.
Ruby-crowned Kinglet *R. calendula*	VR	C		C	Forest undergrowth and open brushlands.
MOTACILLIDAE					
Water Pipit *Anthus spinoletta*	VR	UC		UC	Small ponds, wet fields, and pastures.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
BOMBYCILLIDAE					
Cedar Waxwing* *Bombycilla cedrorum*	C	VC	C	VC	Open shrublands and forests.
LANIIDAE					
Loggerhead Shrike *Lanius ludovicianus*	FC	FC	FC	FC	Open farmlands, grasslands and savannah.
STURNIDAE					
Starling* *Sturnus vulgaris*	A	A	A	A	Agricultural areas, towns, and cities.
VIREONIDAE					
White-eyed Vireo *Vireo griseus*		UC	C	UC	Open woodlands often near a stream or creek.
Bell's Vireo *V. bellii*		R		R	Dense brushlands and forest undergrowth.
Yellow-throated Vireo *V. flavifrons*		UC	C	UC	Dense, relatively mature woodlands.
Solitary Vireo *V. solitarius*		UC	C	UC	Upland forests and forest margins.
Red-eyed Vireo *V. olivaceus*		C	C	C	Woodlands of all types.
Philadelphia Vireo *V. philadelphicus*		UC		FC	Low woody growth.
Warbling Vireo *V. gilvus*		UC	FC	UC	Savannahs and grasslands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
PARULIDAE					
Black-and-White Warbler *Mniotilta varia*	C	C	C	C	Dense broadleafed forests.
Prothonotary Warbler *Protonotaria citrea*		UC	C	UC	Swamps and wet lowland forests.
Swainson's Warbler *Limnothlypis swainsonii*		R	FC	R	Swamps and wet lowland forests.
Worm-eating Warbler *Helmitheros vermivorus*		UC	C	UC	Steep forested slopes.
Golden-winged Warbler *Vermivora chrysoptera*		UC	VR	UC	Openings in hardwood forests.
Blue-winged Warbler *V. pinus*		FC	FC	FC	Brushlands and overgrown hillsides.
Tennessee Warbler *V. peregrina*		C		A	Open forests and shrubby habitat.
Orange-crowned Warbler *V. celata*		VR		VR	Brushlands and forest understory.
Nashville Warbler *V. ruficapilla*		C		C	Early successional forest.
Parula Warbler *Parula americana*		FC	C	FC	Mature bottomland forest.
Yellow Warbler *Dendroica petechia*		C	C	UC	Open locations particularly near water.
Magnolia Warbler *D. magnolia*		C		C	Most wooded situations.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
PARULIDAE (cont'd)					
Cape May Warbler *Dendroica tigrina*		FC		FC	Woodlands and forest edges.
Black-throated Blue Warbler *D. caerulescens*		R	C	R	Edges and understory of upland woods.
Myrtle Warbler *D. coronata*		VC		VC	Most habitats.
Black-throated Green Warbler *D. virens*		C	C	C	Dense broadleafed forests.
Cerulean Warbler *D. cerulea*		UC	C	UC	Mature mixed hardwood forest.
Blackburnian Warbler *D. fusca*		UC	C	UC	Wooded habitats.
Yellow-throated Warbler *D. dominica*		UC	C	UC	Forested areas particularly with sycamores, cypress, and pines.
Chesnut-sided Warbler *D. pensylvanica*		FC	C	C	Woodland clearings and brushlands.
Bay-breasted Warbler *D. castanea*		UC		C	Most forest types.
Blackpoll Warbler *D. striata*		FC		R	Open forest types.
Pine Warbler *D. pinus*		UC	C	UC	Coniferous forest.
Prairie Warbler *D. discolor*		UC	C	UC	Open upland forest and brushland.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1]				Preferred Habitat
	W	Sp	Su	F	
PARULIDAE (cont'd)					
Palm Warbler *Dendroica palmarum*		UC		UC	Forest openings, savannah-type habitats.
Ovenbird *Seiurus aurocapillus*		FC	C	C	Mixed upland woods.
Northern Waterthrush *S. noveboracensis*		FC		C	Woodland streams and creeks.
Louisiana Waterthrush *S. motacilla*		UC	C	UC	Brushy edges of streams and creeks.
Kentucky Warbler *Oporornis formosus*		UC	C	UC	Undergrowth of mature forests.
Connecticut Warbler *O. agilis*		UC			Brush and open areas.
Mourning Warbler *O. philadelphia*		UC		UC	Lowland shrubby sites.
Yellowthroat *Geothlypis trichas*		UC	C	C	Overgrown meadows, pastures, marshes, creeks, and streams.
Yellow-breasted Chat *Icteria virens*		UC	C	UC	Forest edges, brushlands, and overgrown fields.
Hooded Warbler *Wilsonia citrina*		UC	C	UC	Mature forests.
Wilson's Warbler *W. pusilla*		UC		UC	Forest undergrowth, open woods.
Canada Warbler *W. canadensis*		C	C	C	Forest margins and open woods.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
PARULIDAE (cont'd)					
American Redstart *Setopnaga ruticilla*		C	C	C	Edges of lowland forests.
PLOCEIDAE					
House Sparrow *Passer domesticus*	A	A	A	A	Houses, farmlands, and open woods.
ICTERIDAE					
Boblink *Dolichonyx oryzivorus*		C	R	VR	Pastures and fields.
Eastern Meadowlark* *Sturnella magna*	C	C	C	C	Farmlands and grasslands.
Western Meadowlark *S. neglecta*	R	R		R	Farmlands and grasslands.
Redwinged Blackbird* *Agelaius phoeniceus*	C	R	R	R	Pastures, meadows, marshes, and sloughs.
Orchard Oriole *Icterus spurius*		UC	C	UC	Woodland margins, savannah-like areas.
Baltimore Oriole *I. gabula*		FC	UC	R	Brushlands and open woodlands.
Rusty Blackbird *Euphagus carolinus*	R	UC		UC	Marshes, swamps, farmlands, and grasslands.
Brewer's Blackbird *E. cyanocephalus*		R		R	Marshes, swamps, farmlands, and grasslands.
Common Grackle* *Quiscalus quiscula*	C	A	C	A	Urban and suburban areas; farmlands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Pbserved at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
ICTERIDAE (cont'd)					
Brown-headed Cowbird *Molothrus ater*	C	C	C	C	Grasslands ano agricultural areas.
THRAUPIDAE					
Scarlet Tanager *Piranga olivacea*		VC	C	VC	Mixed woodlands.
Summer Tananger *P. rubra*		UC	C	UC	Suburban locales and open forests.
FRINGILLIDAE					
Cardinal* *Richmondena cardinalis*	C	C	C	C	Brushlands, forest undergrowth, woodland margins.
Rose-breasted Grosbeak *Pheucticus ludovicianus*		UC	FC	FC	Lowland forests.
Blue Grosbeak *Guiraca caerulea*		R	FC	R	Brushy borders of creeks and streams.
Indigo Bunting *Passerina cyanea*		C	VC	C	Brush and open woodlands.
Dickcissel *Spiza americana*		UC	C	UC	Old fields and grasslands.
Evening Grosbeak *Hesperiphona vespertina*	R				Residences and forests.
Purple Finch *Carpodacus purpureus*	C	C		C	Old fields, thickets, and forest undergrowth.
Pine Siskin *Spinus pinus*	UC				Open woodlands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	Sp	Su	F	Preferred Habitat
FRINGILLIDAE (cont'd)					
American Goldfinch *Spinus tristis*	C	C	C	C	Brushlands and forest clearings.
Rufous-sided Towhee *Pipilo erythrophthalmus*	C	C	C	C	Early successional woodlands and shrublands.
Savannah Sparrow *Passerculus sandwichensis*		C		C	Pastures, old fields, and grasslands.
Grasshopper Sparrow *Ammodramus savannarum*		UC	C	UC	Grasslands, pasture, and agricultural areas.
LeConte's Sparrow *Passerherbulus caudacutus*		R		R	Marshes and dense grasslands.
Henslow's Sparrow *P. henslowii*		R	FC	R	Tall-grass meadows and marshes.
Vesper Sparrow *Pooecetes gramineus*	VR	C	UC	C	Pastures, farmlands, and grasslands.
Lark Sparrow *Chondestes grammacus*		R	FC	R	Grasslands, and other areas with exposed soil.
Bachman's Sparrow *Aimophila aestivalis*		R	FC	R	Old fields and early successional forest stages.
Slate-colored Junco *Junco hyemalis*	C	C	C	C	Brush, forest undergrowth, and overgrown fencerows.
Tree Sparrow *Spizella arborea*	C	UC		UC	Old fields and forest margins.
Chipping Sparrow *S. passerina*		UC	C	UC	Old fields, forest understory, and brushlands.

Appendix A-3. (cont'd)

Seasonal abundance and habitat preference of birds possibly occurring at the Ghent Power Station area (after Barbour et al. 1973; and Robbins et al. 1966). *=Observed at Ghent Power Station during site visit.

TAXA	Seasonal Abundance[1] W	 Sp	 Su	 F	Preferred Habitat
FRINGILLIDAE (cont'd)					
Field Sparrow *Spizella pusilla*	C	C	C	C	Shrublands.
White-crowned Sparrow* *Zonotrichia leucophrys*	C	UC		UC	Open woodlands, overgrown fencerows, sparse brushlands.
White-throated Sparrow* *Z. albicollis*	C	C		C	Swamps, sparse bottomland forests and forest edges.
Fox Sparrow *Passerella iliaca*	UC	C		C	Brush-lined areas near creeks and streams, old fields.
Lincoln's Sparrow *Melospiza lincolnii*		FC		FC	Forest edges, overgrown fields, and shrublands.
Swamp Sparrow *M. georgiana*	C	C		C	Marshes, emergent vegetation of streams, and forest undergrowth.
Song Sparrow *M. melodia*	C	C	C	C	Shrubby habitat.
Lapland Longspur *Calcarius lapponicus*	UC	R		R	Bare fields and open ground.

Appendix A-4.

Possible occurrence, abundance and habitat preference of mammals at the Ghent Power Station area (after Barbour and Davis 1974; Burt and Grossenheider 1964).

TAXA	Abundance and Preferred Habitat
DIDELPHIDAE	
Virginia Oppossum[*] *Didelphis virginiana*	Abundant; disturbed areas of lower elevations.
SORICIDAE	
Short-tailed Shrew *Blarina brevicauda*	Abundant; forests, brush, and grasslands.
Least Shrew *Cryptotis parva*	Fairly common; less often observed in the eastern half of the state; undisturbed grassy areas.
TALPIDAE	
Eastern Mole *Scalopus aquaticus*	Abundant; dry, sandy soils.
VESPERTILIONIDAE	
Little Brown Bat *Myotis lucifugus*	Common in caves, buildings, and trees.
Keen's Bat *M. keenii*	Uncertain; scarce and local in caves throughout the state.
Indian Bat[**] *M. sodalis*	Associated with major cavernous limestone areas.
Silvered-haired Bat *Lasionycteris noctivagans*	Rare, present only in the winter and during migratory periods; buildings.

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[*] Encountered during site visit.

[**] Listed as "threatened" (U.S. Fish and Wildlife Service 1973: 209) and "endangered" (U.S. Fish and Wildlife Service 1974).

Appendix A-4. (cont'd)

Possible occurrence, abundance and habitat preference of mammals at the Ghent Power Station area (after Barbour and Davis 1974; Burt and Grossenheider 1964).

TAXA	Abundance and Preferred Habitat
VESPERTILIONIDAE	
Eastern Pipistrelle *Pipistrellus subflavus*	Abundant at lower elevations; trees, caves, buildings.
Big Brown Bat *Eptesicus fuscus*	Abundant especially in buildings.
Red Bat *Lasiurus borealis*	Abundant; trees, occasionally in caves.
Hoary Bat *L. cinereus*	Rare; woods.
Evening Bat *Nycticeius humeralis*	Uncertain; probably present only during summer in buildings and hollow trees.
LEPORIDAE	
Eastern Cottontail* *Sylvilagus floridanus*	Abundant in all habitats but prefers brushlands.
SCIURIDAE	
Eastern Chipmunk *Tamias striatus*	Common locally; rocky and forested areas.
Woodchuck* *Marmota monax*	Uncommon; more often seen in the eastern half of the state; open woods, forest margins, rocky outcrops.
Gray Squirrel *Sciurus carolinensis*	Common; hardwood forests, bottomland.
Fox Squirrel* *S. niger*	Fairly common; open woodlands.

Appendix A-4. (cont'd)

Possible occurrence, abundance and habitat preference of mammals at the Ghent Power Station area (after Barbour and Davis 1974; Burt and Grossenheider 1964).

TAXA	Abundance and Preferred Habitat
SCIURIDAE (cont'd)	
Southern Flying Squirrel	Fairly common; hardwood forests.
CASTORIDAE	
Beaver *Castor canadensis*	Fairly common; tree-lined streams and creeks.
CRIYCETIDAE	
Eastern Harvest Mouse *Reithrodontomys humulis*	Uncommon; abandoned fields.
Deer Mouse *Peromyscus maniculatus*	Uncertain; all habitats.
White-footed Mouse *P. leucopus*	Abundant; all areas with adequate cover.
Golden Mouse *Ochrotomys nuttalli*	Uncommon; may not occur in Carroll County; thick forest undergrowth.
Meadow Vole *Microtus pennsylvanicus*	Abundant; grasslands and swamps.
Prairie Vole *M. ochrogaster*	Abundant to the north of, but may not occur in, Muhlenberg County; prairies and grasslands.
Pine Vole *M. pinetorum*	Common to abundant; forests and grasslands with loose soils.
Muskrat* *Odonata zibethicus*	Abundant in marshes, streams, and ponds.
Southern Bog Lemming *Synaptomys cooperi*	Fairly common; dense bluegrass.

Appendix A-4. (cont'd)

Possible occurrence, abundance and habitat preference of mammals at the Ghent Power Station area (after Barbour and Davis 1974; Burt and Grossenheider 1964).

TAXA	Abundance and Preferred Habitat
MURIDAE	
Norway Rat *Rattus norvegicus*	Common in stores and houses.
House Mouse *Mus musculus*	Common; buildings and old fields.
ZAPODIDAE	
Meadow Jumping Mouse *Zapus hudsonius*	Probably uncommon; grasslands.
CANIDAE	
Red Fox* *Vulpes vulpes*	Common; cultivated lands and forest margins.
Gray Fox *Urocyon cinereoargenteus*	Common; brush and wooded habitats.
URSIDAE	
Black Bear *Ursus americanus*	Probably absent but historically present.
PROCYONIDAE	
Raccoon* *Procyon lotor*	Abundant; most habitats, but more commonly woodlands.
MUSTELIDAE	
Long-tailed Weasel *Mustela frenata*	Fairly common; most areas near water.
Mink* *M. vision*	Common; streams, lakes, and rivers.

Appendix A-4. (cont'd)

Possible occurrence, abundance and habitat preference of mammals at the Ghent Power Station area (after Barbour and Davis 1974; Burt and Grossenheider 1964).

TAXA	Abundance and Preferred Habitat
MUSTELIDAE (cont'd)	
Striped Skunk*	Common; brush and grasslands.
FELIDAE	
Bobcat *Lynx rufus*	Scarce; brush, woodlands, other undisturbed areas.
CERVIDAE	
White-tailed Deer* *Odocoileus virginianus*	Fairly common; woods, brush, forest margins.

Appendix A-5.

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Old-Fields, Abandoned Fields, Abandoned Pasture, Roadsides

Three-seeded mercury	*Acalypha rhomboidea* Raf.
Yarrow	**Achillea millefolium* L.
Garlic-mustard	*Alliaria officinalis* Andrz.
Wild onion	*Allium canadense* L.
Thorny amaranth	**Amaranthus spinosus* L.
Ragweed	**Ambrosia artemisiifolia* L.
Giant ragweed	**Ambrosia trifida* L.
Mayweed	**Anthemus cotula* L.
Indian hemp	*Apocynum cannabinum* L.
Smooth rock-cress	*Arabis laevigata* (Muhl.) Poir
Common burdock	**Arctium minus* Schk.
Sweet wormwood	**Artemisia annua* L.
Common mugwort	*Artemisia vulgaris* L.
Common milkweed	**Asclepias syriaca* L.
Asparagus	*Asparagus officinalis* L.
Heath aster	*Aster ericoides* L.
Oats	**Avena sativa* L.
Winter cress	**Barbarea vulgaris* R.Br.
Sticktight	**Bidens vulgata* Greene
Leafy-bracted begger tick	*Bidens tripartita* L.
Brome grass	**Bromus inermis* L.
Brome grass	*Bromus japonicus* Thunb.
Trumpet creeper	*Campsis radicans* (L.) Seem.
Shepherd's purse	**Capsella bursa-pastoris* L.
Nodding thistle	*Carduus nutans* L.
Mouse-ear chickweed	**Cerastium vulgatum* L.
Lambs quarters	**Chenopodium album* L.
Mexican tea	**Chenopodium ambrosioides* L.
Ox-eye daisy	**Chrysanthemum luecanthemum* L.
Chicory	**Cichorium intybus* L.
Poison hemlock	*Conium maculatum* L.
Hedge bindweed	**Convolvulus sepium* L.
Orchard grass	**Dactylis glomerata* L.
Jimson weed	**Datura stramonium* L.
Wild carrot	*Daucus carota* L.
Pointed-leaf tick trefoil	**Desmodium glutinosum* (Muhl.) Wood
Smooth crab grass	*Digitaria ischaemum* (Schreb.) Schreg. ex.Muhl.
Teasel	**Dipsacus sylvestris* Huds.
Barnyard grass	**Echinochloa crus-galli* (L.) Beauv.
	Eclipta alba (L.) Hassk.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Old-Fields, Abandoned Fields, Abandoned Pasture, Roadsides

Yard grass	*_Eleusine indica_ (L.) Gaertn.
Wild rye	_Elymus virginicus_ L.
Love grass	_Eragrostis poaeoides_ Beauv.
Stinking love grass	_Eragrostis cilianensis_ (All.) Link.
Fleabane	*_Erigeron canadense_ = _Conyza canadensis_ (L.) Cronquist
Fleabane	_Erigeron philadelphicus_ L.
Mist flower	*_Eupatorium coelestinum_ L.
Joe-pye weed	*_Eupatorium fistulosum_ Barratt.
Spotted joe-pye weed	*_Eupatorium purpureum_ L.
Wartweed	_Euphorbia maculata_ L.
Fescue	*_Festuca_ sp.
Morning glory	*_Ipomoea purpurea_ (L.) Roth
Wild lettuce	*_Lactuca canadensis_ L.
Prickly lettuce	*_Lactuca scariola_ L.
Henbit	*_Lamium amplexicaule_ L.
Purple dead-nettle	*_Lamium purpureum_ L.
Cow-cress	*_Lepedium campestris_ (L.) R. Br.
Poor man's pepper	*_Lepedium virginicum_ L.
Pineapple weed	_Matricaria matricarioides_ (Less.) Porter
Alfalfa	*_Medicago sativa_ L.
Korean clover	_Lespedeza stipulacea_ Maxim.
Japanese clover	_Lespedeza striata_ (Thunb.) H. & A.
Black medick	_Medicago lupulina_ L.
White sweet clover	*_Melilotus alba_ Desr.
Yellow sweet clover	*_Melilotus officinalis_ (L.) Desr.
Evening primrose	*_Oenothera biennis_ L.
Yellow wood sorrel	_Oxalis stricta_ L.
Panic grass	_Panicum_ sp.
Parsnip	_Pastinaca sativa_ L.
Ditch stonecrop	_Penthorum sedioides_ L.
Timothy grass	*_Phleum pratense_ L.
Fog fruit	_Phyla lanceolata_ (Michx.) Greene
Pokeweed	*_Phytolacca americana_ L.
English plantain	*_Plantago lanceolata_ L.
Pale plantain	*_Plantago rugelii_ Decne.
Bluegrass	*_Poa_ sp.
Lady's thumb	*_Polygonium persicaria_ L.
Pennsylvania smartweed	*_Polygonum pensylvanicum_ L.
False buckwheat	_Polygonum scandens_ L.
Knotweed	*_Polygonum_ sp.
Cinquefoil	*_Potentilla recta_ L.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Old-Fields, Abandoned Fields, Abandoned Pasture, Roadsides

Kidney buttercup	*Ranunculus abortivus* L.
Multiflora rose	**Rosa multiflora* Thunb.
Blackberry	**Rubus* sp.
Black-eyed susan	**Rudbeckia hirta* L.
Red sorrel	*Rumex acetosella* L.
Curled dock	**Rumex crispus* L.
Bitter dock	*Rumex obtusifolius* L.
Bouncing bet	*Saponaria officinalis* L.
Butterweed	*Senecio glabellus* Poir.
Nodding foxtail	**Setaria faberii* Herm.
Common millet	**Setaria italica* (L.) Beauv.
Green foxtail	*Setaria viridus* (L.) Beauv.
Prickly mallow	**Sida spinosa* L.
Hedge mustard	*Sisymbrium officinale* (L.) Scop.
Horse-nettle	**Solanum carolinese* L.
Nightshade	*Solanum nigrum* L.
Goldenrod	**Solidago canadensis* L.
Johnson grass	**Sorghum halpense* (L.) Pers.
Common chickweed	**Stellaria media* (L.) Cyrill.
Coralberry	**Sympharicarpos orbiculatus* Moench.
Common dandelion	**Taraxacum officinale* Weber
Purple top	*Tridens* sp.
Smaller hop clover	**Trifolium procumbens* L.
Red clover	**Trifolium pratense* L.
White clover	*Trifolium repens* L.
Wheat	*Triticum aestivum* L.
Wooly mullein	**Verbascum thapsus* L.
White vervain	*Verbena urticifolia* L.
Speedwell	**Veronica* sp.
Violet	*Viola striata* Ait.
Cocklebur	**Xanthium strumarium* L.
Thistle	**Cirsium discolor* (Muhl.) Spreng.
Corn	**Zea mays* L.
Hedge parsley	*Torilis japonica* (Houtt.) Dc.
Deptford pink	*Dianthus armeria* L.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Bottomland Woods

Box elder	*_Acer negundo_ L.
Silver maple	*_Acer saccharinum_ L.
Yellow buckeye	_Aesculus octandra_ Marsh.
Giant hyssop	_Agastache nepetoides_ (L.) Kuntze.
Garlic-mustard	_Alliaria officinalis_ Andrz.
Blue vine	_Ampelamus albidus_ (Nutt.) Britt.
Hog peanut	_Amphicarpa bracteata_ (L.) Fern.
Papaw	*_Asimina triloba_ (L.) Dunal.
New England aster	_Aster novae-angliae_ L.
False nettle	_Boehmeria cylindrica_ (L.) Sw.
Pecan	_Carya illinoensis_ (Wang.) K. Koch.
Big shellbark hickory	*_Carya laciniosa_ (Michx. f.) Loud.
Bitternut hickory	*_Carya cordiformis_ (Wang.) K. Koch.
Catalpa	*_Catalpa speciosa_ Warder
Hackberry	*_Celtis occidentalis_ L.
Redbud	*_Cercis canadensis_ L.
Hornwort	_Cryptotaenia canadensis_ (L.) Dc.
Mist flower	*_Eupatorium coelestinum_ L.
Spotted joe-pye weed	*_Eupatorium purpureum_ L.
White ash	*_Fraxinus americana_ L.
Honey locust	*_Gleditsia triacanthos_ L.
Kentucky coffee tree	*_Gymnocladum dioica_ (L.) K. Koch.
Witch hazel	_Hamamelis virginiana_ L.
Sneezeweed	_Helenium autumnale_ L.
Spotted touch-me-not	*_Impatiens biflora_ Walt.
Pale touch-me-not	_Impatiens pallida_ Nutt.
False rocket	_Iodanthus pinnatifidus_ (Michx.) Stend.
Black walnut	*_Juglans nigra_ L.
Red cedar	*_Juniperus virginiana_ L.
Wood nettle	_Laportea canadensis_ (L.) Wedd.
Wild lettuce	*_Lactuca canadensis_ L.
White grass	_Leersia virginica_ Willd.
Blue lettuce	_Lactuca floridana_ (L.) Gaertn.
Motherwort	_Leonurus cardiaca_ L.
Sweet gum	_Liquidambar styraciflua_ L.
Bugle weed	_Lycopus virginicus_ L.
Moneywort	_Lysimachia nummularia_ L.
Osage-orange	*_Maclura pomifera_ (Raf.) Schneid.
Mulberry	*_Morus rubra_ L.
Yellow wood sorrel	_Oxalis stricta_ L.
Panic grass	_Panicum_ sp.
Virginia creeper	*_Parthenocissus quinquefolia_ (L.) Planch.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Bottomland Woods

Empress tree	*Paulownia tomentosa* (Thunb.) Steud.
Beef-steak plant	*Perilla frutescens* (L.) Britt.
Timothy grass	**Phleum pratense* L.
Clammy ground cherry	*Physalis heterophylla* Nees.
Sycamore	**Platanus occidentalis* L.
Self-heal	*Prunella vulgaris* L.
Yellow oak	**Quercus muhlenbergii* Engelm. *(Q. prinoides var. acuminata)*
Poison ivy	**Rhus radicans* L.
Black locust	**Robinia pseudoacacia* L.
Black willow	**Salix nigra* Marsh.
Skullcap	*Scutellaria* sp.
Bur-cucumber	*Sicyos angulatus* L.
Wild bean	*Strophostyles helveola* (L.) Ell.
Wood-sage	*Teucrium canadense* L.
Basswood	**Tilia neglecta* Spach.
American elm	**Ulmus americana* L.
Slippery elm	**Ulmus rubra* Muhl.
Stinging nettle	*Urtica chamaedryoides* Pursh.
Stinging nettle	*Urtica dioica* L.
Yellow ironweed	**Verbesina alternifolia* (L.) Britt.
Ironweed	*Veronia altissima* Nutt.

Upland Woods

Box elder	**Acer negundo* L.
Sugar maple	**Acer saccharum* Marsh.
Ohio buckeye	**Aesculus glabra* Willd.
Tree-of-heaven	**Ailanthus altissima* (mill.) Swingle
Garlic-mustard	*Alliaria officinalis* Andrz.
Service berry	*Amelanchier arborea* (Michx. f.) Fernald
Thimbleweed	*Anemone virginiana* L.
Rue anemone	*Anemonella thalictroides* (L.) Spach.
Smooth rock-cress	*Arabis laevigata* (Muhl.) Poir.
Jack-in-the-pulpit	*Arisaema spinosa* L.
Hercules club	*Aralia spinosa* L.
Wild ginger	*Asarum canadense* L.
Papaw	**Asimina triloba* (L.) Dunal.
Ebony spleenwort	*Asplenium platyneuron* (L.) Oakes
Crooked stem aster	*Aster prenanthoides* Muhl.
Spanish needles	**Bidens bipinnata* L.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Upland Woods

Virginia grape fern	*Botrychium virginianum* (L.) Sw.
Downy chess	*Bromus tectorum* L.
Wild hyacinth	*Camassia scilloides* (Raf.)
Carex	*Carex* sp.
Ironwood	**Carpinus caroliniana* Walt.
Bitternut hickory	**Carya cordiformis* (Wang.) K. Koch.
Big shellbark hickory	**Carya laciniosa* (Michx. f.) Loud
Shagbark hickory	**Carya ovata* (Mill.) K. Koch.
Mockernut hickory	**Carya tomentosa* Nutt.
Hackberry	**Celtis occidentalis* L.
Redbud	**Cercis canadensis* L.
Spreading chervil	*Chaerophyllum procumbens* (L.) Crantz.
Chicory	**Cichorium intybus* L.
Spring beauty	*Claytonia virginica* L.
Blue-eye-mary	*Collinsia verna* Nutt.
Day flower	*Commelina communis* L.
Bindweed	**Convolvulus* sp.
Dogwood	**Cornus drummondii* C. A. Meyer
Flowering dogwood	**Cornus florida* L.
Green violet	*Cubelium concolor* (Forst.) Raf.
Orchard grass	**Dactylis glomerata* L.
Larkspur	**Delphinium tricorne* Michx.
Cut-leaved toothwort	*Dentaria laciniata* Muhl.
Squirrel corn	*Dicentra canadensis* (Goldie) Walp.
Dutchman's breeches	*Dicentra cucullaria* (L.) Bernh.
Persimmon	**Diospyros virginiana* L.
Fleabane	**Erigeron philadelphicus* L.
Adder's tongue	*Erythronium americanum* Ker.
Wahoo	*Euonymus atropurpureus* Jacq.
Mist flower	**Eupatroium coelestinum* L.
Beech	**Fagus grandifolia* Ehrh.
Fescue	**Festuca* sp.
Wild strawberry	*Fragaria virginiana* Duchesne.
White ash	**Fraxinus americana* L.
Cleavers	*Galium aparine* L.
Sweet-scented bedstraw	*Galium triflorum* Michx.
Carolina cranesbill	*Geranium carolinianum* L.
Geranium	*Geranium maculatum* L.
White avens	*Geum canadense* Jacq.
Avens	*Geum vernum* (Raf.) T. & G.
Ground ivy	*Glecoma hederacea* L.
Honey locust	**Gleditsia triacanthos* L.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Upland Woods

Day lily	_Hemerocallis fulva_ L.
Hepatica	_Hepatica acutiloba_ DC.
Hydrangea	_Hydrangea arborescens_ L.
Appendaged waterleaf	_Hydrophyllum appendiculatum_ Michx.
Bottle-brush grass	*_Hystrix patula_ Moench. = _Elymus hystrix_ L.
Touch-me-not	*_Impatiens_ sp.
Twinleaf	_Jeffersonia diphylla_ (L.) Pers.
Black walnut	*_Juglans nigra_ L.
Red cedar	*_Juniperus virginiana_ L.
Spicebush	*_Lindera benzoin_ (L.) Blume
Japanese honeysuckle	*_Lonicera japonica_ Thunb.
Tulip poplar	*_Liriodendron tulipifera_ L.
Osage-orange	*_Maclura pomifera_ (Raf.) Schneid
White sweet clover	*_Melilotus alba_ Desr.
Yellow sweet clover	*_Melilotus officinalis_ (L.) Desr.
Moonseed	_Menispermum canadense_ L.
Virginia bluebells	_Mertensia virginica_ (L.) Pers.
Mulberry	*_Morus rubra_ L.
Evening primrose	*_Oenothera biennis_ L.
Star-of-bethlehem	_Ornithogalium umbellatum_ L.
Hop-hornbeam	*_Ostrya virginiana_ (Mill.) K. Koch.
Sourwood	*_Oxydendrom arboreum_ (L.) DC.
Virginia creeper	*_Parthenocissus quinquefolia_ (L.) Planch.
Miami mist	_Phacelia purshii_ Buchl.
Blue phlox	_Phlox divaricata_ L.
Sycamore	*_Platanus occidentalis_ L.
Mayapple	_Podophyllum peltatum_ L.
Greek valerian	_Polemonium reptans_ L.
Bluegrass	*_Poa_ spp.
Solomon's-seal	_Polygonatum biflorum_ (Walt.) Ell.
Black cherry	*_Prunus serotina_ Ehrh.
White oak	*_Quercus alba_ L.
Yellow oak	*_Quercus muhlenbergii_ Engelm (= _Q. prinoides var. acuminata)_
Bur oak	*_Quercus macrocarpa_ Michx.
Red oak	*_Quercus borealis_ Michx. f. var. _maxima_ (Marsh.)As
Black oak	*_Quercus velutina_ Lam.
Buckthorn	*_Rhamnus carolineanus_ Walt.
Fragrant sumac	_Rhus aromatica_ Ait.
Shiny sumac	*_Rhus glabra_ L.
Poison ivy	*_Rhus radicans_ L.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Upland Woods

Black locust	**Robinia pseudoacacia* L.
Blackberry	**Rubus* sp.
Multiflora rose	**Rosa multiflora* Thunb.
American elder	**Sambucus canadensis* L.
Bloodroot	*Sanguinaria canadensis* L.
Wild stonecrop	*Sedum ternatum* Michx.
Sassafras	**Sassafras albidum* (Nutt.) Nees
Butterweed	*Senecio glabellus* Poir.
Fire pink	*Silene virginica* L.
Blue-eye grass	*Sisyrinchium angustifolium* Mill.
False solomon's seal	*Smilacina racemosa* (L.) Desf.
Catbrier	**Smilax glauca* Walt.
Hispid greenbrier	*Smilax hispida* Muhl.
Horse-nettle	**Solanum carolinese* L.
Nightshade	*Solanum nigrum* L.
Wood poppy	*Stylophorum diphyllum* (Michx.) Nutt.
Bladdernut	*Staphylea trifolia* L.
Coralberry	**Symphoricarpos orbiculatus* Moench.
Meadow rue	*Thalictrum revolutum* DC.
White basswood	**Tilia heterophylla* Vent.
Spiderwort	*Tradescantia* sp.
Trillium	*Trillium sessile* L.
American elm	**Ulmus americana* L.
Slippery elm	**Ulmus rubra* Muhl.
Large-flowered bellwort	*Uvularia grandiflora* Sm.
Southern black-haw	*Viburnum rufidulum* Raf.
Yellow violet	*Viola pensylvanica* Michx.
Blue violet	*Viola papilionacea* Pursh.
Grape	**Vitis* sp.
Golden alexanders	*Zizia aptera* (Gray) Fernald

Stream Margins and Moist Beds (Riparian vegetation)

Three-seeded mercury	*Acalypha rhoboidea* Raf.
Box elder	**Acer negundo* L.
Silver maple	**Acer saccharinum* L.
Sugar maple	**Acer saccharum* Marsh.
Tall bellflower	*Campanula americana* L.
Ironwood	**Carpinus caroliniana* Walt.
Hackberry	**Celtis occidentalis* L.
Ohio buckeye	**Aesculus glabra* Willd.
False indigo	*Amorpha fruticosa* L.

Appendix A-5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Stream Margins and Moist Beds (Riparian vegetation)

Papaw	*_Asimina triloba_ (L.) Dunal.
Redbud	*_Cercis canadensis_ L.
Croton	_Croton mononthogynus_ Michx.
Blue waxweed	_Cuphea petiolata_ (L.) Koehne
Scouring rush	*_Equisetum arvense_ L.
Beech	*_Fagus grandifolia_ Ehrh.
White ash	*_Fraxinus americana_ L.
Blue ash	*_Fraxinus quadrangulata_ Michx.
Honey locust	*_Gleditsia triacanthos_ L.
Stickseed	_Hackelia virginiana_ (L.) Johnst.
Spotted touch-me-not	*_Impatiens biflora_ Walt.
Pale touch-me-not	_Impatiens pallida_ Nutt.
False rocket	_Iodanthus pinnatifidus_ (Michx.) Stend.
Tulip poplar	*_Liriodendron tulipifera_ L.
Black walnut	*_Juglans nigra_ L.
Blue cardinal flower	_Lobelia siphilitica_ L.
Water purslane	_Ludwigia palustris_ (L.) Ell.
Fringed loosestrife	_Lysimachia ciliata_ L.
Moneywort	_Lysimachia nummularia_ L.
Monkey flower	_Mimulus alatus_ Ait.
Osage-orange	*_Maclura pomifera_ (Raf.) Schneid.
Carpetweed	_Mollugo verticillata_ L.
Clearweed	_Pilea pumila_ (L.) Gray
Catnip	_Nepeta cataria_ L.
Hop-hornbeam	*_Ostrya virginiana_ (Mill.) K. Koch.
Sycamore	*_Platanus occidentalis_ L.
Leaf-cup	*_Polymnia canadensis_ L.
False buckwheat	_Polygonum scandens_ L.
Cottonwood	*_Populus deltoides_ Marsh.
Black cherry	*_Prunus serotina_ Ehrh.
Yellow oak	*_Quercus muhlenbergii_ Engelm.
Black oak	*_Quercus velutina_ Lam.
Black locust	*_Robinia pseudoacacia_ L.
Bouncing bet	_Saponaria officinalis_ L.
Figwort	_Scrophularia marilandica_ L.
Wild stonecrop	_Sedum ternatum_ Michx.
Venus' looking-glass	_Triodanis perfoliata_ (L.) Neuwl.
American elm	*_Ulmus americana_ L.
Moth mullein	_Verbascum blattaria_ L.
Southern black-haw	_Viburnum rufidulum_ Raf.
St. John's-wort	_Hypericum_ sp.

Appendix A5. (cont'd)

Plant species known to occur in the project area arranged by community (* = sighted during reconnaisance on 21 August 1975).

Ponds and areas of standing water

American water plantain	*Alisma subcordatum* Raf.
Fox sedge	*Carex vulpinoidea* Michx.
Gray sedge	*Carex grisea* Wahl.
Sedge	*Cyperus* sp.
Spike rush	*Eleocharis* spp.
Soft rush	*Juncus effusus* L.
Path rush	*Juncus tenuis* Willd.
Upright primrose willow	*Jussiaea decurrens* (Walt.) DC.
Creeping primrose willow	*Jussiaea repens* L.
Duckweed	**Lemna* sp.
Long-leaved pond weed	**Potamogeton americanus*
Dark-green bulrush	*Scirpus atrovirens*
Cattail	**Typha latifolia*

Appendix A-6.

List of threatened or endangered species of plants that have been reported to grow in Kentucky (Federal Register, Vol. 40, No. 127, 1975).

Threatened

Groundnut	*Aprios priceana* Robinson
Sandwort	*Arenaria fontinalis* (Short & Peter) Shinners
Spleenwort	*Asplenium kentuckiense* McCoy
False foxgloves	*Aureolaria patula* (Chapm.) Pennell
Sedge	*Carex purpurifera* MacKenzie
White lady's-slipper	*Cypripedium candidum* Muhl.
Shooting star	*Dodecatheon franchii* Rydb.
St. John's-wort	*Hypericum sphaerocarpum var. turgidum* (Small) Svenson
Leavenworthia	*Leavenworthia torulosa* Gray
Lesquerella	*Lesquerella globos* (Dexv.) Wats.
Torrey's muhlenbergia	*Muhlenbergia torreyana* (Schult.) A.S. Hitchcock
Phlox	*Phlox bifida var. stellaria* Wherry
Pale green orchis	*Platanthera flava = Habeneria flava* (L.) R.Br.
Purple fringeless orchis	*Platanthera peramoeba = Habenaria peramoeba* Gray
Greek valerian	*Polemonium reptans var. villosam* Braun
Rattlesnake root	*Prenanthes roanensis*
Saxifrage	*Saxifraga caroliniana* Gray
Chickweed	*Stellaria fontinalis = Arenaria fontinalis* (Short & Peter) Robinson
Sullivantia	*Sullivantia ohionis*
	Thododendron bakeri (Lemmon & McKay) Hume
Eggleston's violet	*Viola egglestonii* Brainerd

Endangered

Rock cress	*Arabis perstellata var. perstellata* Braun
Whorled conradina	*Conradina verticillata*
Resinous eupatorium	*Eupatorium resinosum var. kentuckiense*
Sunflower	*Helianthus eggertii* Small
Leavenworthia	*Leavenworthia exigua var. laciniata* Rollins
Goldenrod	*Solidago albopilosa* Braun
Goldenrod	*Solidago shortii* T. & G. = *Aster rafinesquii* J. Ktze.

Appendix A-7.

Amphibians and reptiles which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973), in Trimble County, Kentucky (Water Resources Laboratory 1975), and along the proposed transmission corridors.

Order Caudata:

	Hellbender	*Cryptobranchus alleganiensis*
	Jefferson's Salamander	*Ambystoma jeffersonianum*
	Small-mouthed Salamander	*A. texanum*
	Marbled Salamander	*A. opacum*
	Spotted Salamander	*A. maculatum*
	Tiger Salamander	*A. tigrinum*
	Newt	*Notophthalmus viridescens*
	Dusky Salamander	*Desmognathus fuscus*
	Red-backed Salamander	*Plethodon cinereus*
	Zig-zag Salamander	*P. dorsalis*
1	Slimy Salamander	*P. glutinosus*
	Four-toed Salamander	*Hemidactylium scutatum*
	Mud Salamander	*Pseudotriton montanus*
1	Two-lined Salamander	*Eurycea bislineata*
1	Long-tailed Salamander	*E. longicauda*
	Cave Salamander	*E. lucifuga*
	Mudpuppy	*Necturus maculosus*

Order Anura:

	Spadefoot Toad	*Scaphinopus holbrooki*
1	Bullfrog (H)	*Rana catesbeiana*
1,2	Green Frog	*Rana clamitans*
1	Leopard Frog	*R. pipiens*
1	Pickerel Frog	*Rana palustris*
	Wood Frog	*R. sylvatica*
	American Toad	*Bufo americanus*
1	Fowler's Toad	*B. woodhousei*
1	Cricket Toad	*Acris crepitans*
1	Spring Peeper	*Hyla crucifer*
1	Gray Treefrog	*Hyla versicolor*
	Chorus Frog	*Pseudacris triseriata*

(?) Occurrence in area is questionable
(1) Observed in Trimble County, 1975
(2) Observed along transmission corridors, August 1976

Appendix A-7. (cont'd)

Amphibians and reptiles which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973), in Trimble County, Kentucky (Water Resources Laboratory 1975), and along the proposed transmission corridors.

Order Testudinata:

1	Snapping Turtle	*Chelydra serpentina*
	Stinkpot	*Sternotherus odoratus*
1,2	Box Turtle	*Terrapene carolina*
	Map Turtle	*Graptemys geographica*
1,2	Painted Turtle	*Chrysemys picta*
	Smooth Softshell Turtle	*Trionyx muticus*
	Spiny Softshell Turtle	*Trionyx spinifer*
	Red-eared Turtle	*Pseudemys scripta*

Order Squamata:

1	Fence Lizard	*Sceloporus undulatus*
	Five-lined Skink	*Eumeces fasciatus*
	Broad-headed Skink (?)	*E. laticeps*
	Ground Skink	*Scincella laterale*
	Worm Snake	*Carphomis amoenus*
	Ringneck Snake	*Diadophis punctatus*
1	Hognose Snake	*Heterodon platyrhinos*
1	Rough Green Snake	*Opheodrys aestivus*
1	Black Racer	*Coluber constrictor*
	Rat Snake	*Elaphe obsoleta*
	Kingsnake (?)	*Lampropeltis getulus*
	Milk Snake	*Lampropeltis doliata*
	Red Milk Snake	*Lampropeltis triangulum*
	Prairie Kingsnake	*Lampropeltis calligaster*
	Northern Red-bellied Snake	*Storeria occipitomacula*
	Southeastern Crowneared Snake	*Tantilla coronata*
	Eastern Ribbon Snake	*Thamnophis sauritus*
1	Garter Snake	*T. sirtalis*
	Earth Snake (?)	*Virginia valeriae*
	Brown Snake (?)	*Storeria dekayi*
	Queen Water Snake	*Regina septembittata*
	Kirtland's Water Snake	*Natrix kirtlandi*
1	Common Water Snake	*N. sipedon*
	Copperhead	*Agkistrodon contortrix*
	Rattlesnake	*Crotalus horridus*

(?) Occurrence in area is questionable
(1) Observed in Trimble County, 1975
(2) Observed along transmission corridors, August 1976

Appendix A-8.

Birds which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973) and which were observed in Trimble County, Kentucky and along the transmission corridors.

	Common loon (V)	*Gavia immer*
	Pied-billed grebe (S)	*Podilymbus podiceps*
	Double-crested cormorant (V)	*Phalacrocorax auritus*
1	Great blue heron (V)	*Ardea herodias*
1,2	Green heron (S)	*Butorides virescens*
	Common egret (V)	*Casmerodius albus*
1	Black-crowned night heron (V)	*Nycticorax nycticorax*
	Yellow-crowned night heron (V)	*Nyctanassa violacea*
	American bittern (S)	*Botaurus lentiginosus*
	Least bittern (S)	*Ixobrychus exilis*
	Glossy ibis (V)	*Plegadis falcinellus*
	Whistling swan (V)	*Olor columbianus*
1	Canada goose (M)(H)	*Branta canadensis*
	Snow goose (M)(H)	*Chen hyperborea*
1	Mallard (M)(H)	*Anas platyrhynchos*
	Black duck (M)(H)	*Anas rubripes*
	Gadwall (M)(H)	*Anas strepera*
	Pintail (M)(H)	*Anas acuta*
	Green-winged teal (M)(H)	*Anas carolinensis*
	Blue-winged teal (M)(H)	*Anas discors*
	American widgeon (M)(H)	*Mareca americana*
	Shoveller (M)(H)	*Spatula clypeata*
1	Wood duck (S)(H)	*Aix sponsa*
	Ring-necked duck (M)(H)	*Aythya collaris*
	Canvasback (M)(H)	*Aythya valisineria*
	Lesser scaup (M)(H)	*Aythya affinis*
	Common goldeye (M)(H)	*Bucephala clangula*
	Bufflehead (M)(H)	*Glaucionetta albeola*
	Ruddy duck (M)(H)	*Oxyura jamaicensis*
	Hooded merganser (M)(H)	*Lophodytes cucullatus*
	American merganser (M)(H)	*Mergus merganser*
1,2	Turkey vulture (S)	*Cathartes aura*

H - hunted for sport
M - migrant
P - permanent breeding resident
R - rare and/or endangered
S - summer resident, locally breeding
V - visitant, not breeding locally
W - winter resident, absent during breeding season
1 - observed in Trimble County, Kentucky in 1975 (Water Resources Laboratory 1975)
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Appendix A-8. (cont'd)

Birds which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973) and which were observed in Trimble, County, Kentucky and along the transmission corridors.

2	Black vulture (S)	*Coragyps atratus*
	Mississippi kite (V)	*Ictinia missippiensis*
	Sharp-shinned hawk (P)	*Accipiter striatus*
1	Cooper's hawk (P)	*Accipiter cooperii*
	Marsh hawk (S)	*Circus cyaneus*
1	Red-tailed hawk (P)	*Buteo jamaicensis*
	Red-shouldered hawk (P)	*Buteo lineatus*
	Broad-winged hawk (S)	*Buteo platypterus*
	Golden eagle (V)	*Aquila chrysaetos*
	Bald eagle (V)	*Haliaeetus leucocephalus*
	Osprey (V)	*Pandion haliaetus*
	Peregrine falcon (P)(R)	*Falco peregrinus*
1	Sparrow hawk (P)	*Falco sparverius*
1	Bobwhite (P)(H)	*Colinus virginianus*
1,2	Robin (P)	*Turdus migratorius*
1	Woodthrush (S)	*Hylocichla mustelina*
1	Hermit thrush (W)	*Hylocichla guttata*
1	Gray-cheeked thrush (M)	*Hylocichla minima*
1	Swainson's thrush (M)	*Hylocichla ustulata*
1	Veery (M)	*Hylocichla fuscescens*
1,2	Eastern bluebird (P)	*Sialia sialis*
1	Blue-gray gnatcatcher (S)	*Polioptila caerulea*
	Golden-crowned kinglet (W)	*Regulus satrapa*
	Water pipit (M)	*Anthus spinoletta*
1	Cedar waxwing (W)	*Bombycilla cedrorum*
2	Loggerhead shrike (P)	*Lanius ludovicianus*
1,2	Starling (P)	*Sturnus vulgaris*
1	White-eyed vireo (S)	*Vireo griseus*
	Yellow-throated vireo (S)	*Vireo flavifrons*
1	Red-eyed vireo (S)	*Vireo olivaceus*
	Philadelphia vireo (M)	*Vireo philadelphicus*
1	Warbling vireo (S)	*Vireo gilvus*

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Appendix A-8. (cont'd)

Birds which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973) and which were observed in Trimble County, Kentucky and along the transmission corridors.

1	Black and white warbler (S)	*Mniotilta varia*
	Swainson's warbler (S)	*Limnothlypis swainsonii*
1	Worm-eating warbler (S)	*Helmitheros vermivorus*
1	Blue-winged warbler (S)	*Vermivora pinus*
	Golden-winged warbler (M)	*Vermivora chrysoptera*
	Tennesse warbler (M)	*Vermivora peregrina*
	Nashville warbler (M)	*Vermivora ruficapilla*
1,2	Yellow warbler (S)	*Dendroica petechia*
1	Magnolia warbler (M)	*Dendroica magnolia*
1	Myrtle warbler (W)	*Dendroica coronata*
	Black-throated green warbler (M)	*Dendroica virens*
1	Cerulean warbler (S)	*Dendroica cerulea*
	Blackburnian warbler (M)	*Dendroica fusca*
	Yellow-throated warbler (S)	*Dendroica dominica*
	Chestnut-sided warbler (M)	*Dendroica pensylvanica*
	Bay-brested warbler (M)	*Dendroica castanea*
1	Blackpoll warbler (M)	*Dendroica striata*
1	Pine warbler (S)	*Dendroica pinus*
1	Prairie warbler (S)	*Dendroica discolor*
1	Palm warbler (M)	*Dendroica palmarum*
	Ovenbird (S)	*Seriurus aurocapillus*
	Louisiana water-thrush (S)	*Seriurus motacilla*
1,2	Kentucky warbler (S)	*Opornornis formosus*
	Connecticut warbler (S)	*Opornornis agilis*
1	Mourning warbler (M)	*Opornornis philadelphia*
1	Yellow throat (S)	*Geothlypis trichas*
1	Yellow-breasted chat (S)	*Icteria virens*
	Hooded-warbler (S)	*Wilsonia citrina*
1	Wilson's warbler (M)	*Wilsonia pusilla*
1	Canada warbler (M)	*Wilsonia canadensis*
1	American redstart (M)	*Setophaga ruticilla*
1	Prothonotary warbler (M)	*Protonotaria citrea*

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Appendix A-8. (cont'd)

Birds which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973) and which were observed in Trimble County, Kentucky and along the transmission corridors.

1,2	House sparrow (P)	*Passer domesticus*
1,2	Eastern meadowlark (P)	*Sturnella magna*
1,2	Red-winged blackbird	*Agelaius phoeniceus*
1	Orchard oriole (S)	*Icterus spurius*
	Common gallinule (M)	*Gallinula chloropus*
1	American coot (M)(H)	*Fulica americana*
1	Killdeer (P)	*Charadrius vociferus*
	Woodcock (P)(H)	*Philohela minor*
	Spotted sandpiper (S)	*Actitis macularia*
1	Herring gull (H)	*Larus argentatus*
	Rockdove (P)	*Columba livia*
1,2	Mourning dove (P)	*Zenaidura macroura*
1	Yellow-billed cuckoo (S)	*Coccyzus americanus*
1	Black-billed cuckoo (M)	*Coccyzus erythrophthalmus*
	Barn owl (P)	*Tyto alba*
1	Screech owl (P)	*Otus asio*
1	Great horned owl (P)	*Bubo virginianus*
	Barred owl (P)	*Strix varia*
1	Whippoorwill (S)	*Caprimulgus vociferous*
1	Chuck-will's widow (S)	*Caprimulgus carolinensis*
1	Common night hawk (S)	*Chordeiles minor*
1,2	Chimney swift (S)	*Chaetura pelagica*
	Ruby-throated hummingbird (S)	*Archilochus colubris*
1	Belted kingfisher (P)	*Megaceryle alcyon*
1,2	Yellow-shafted flicker (P)	*Colaptes auratus*
1	Pileated woodpecker (P)	*Dryocopus pileatus*
1	Red-bellied woodpecker (P)	*Centurus carolinus*
1	Red-headed woodpecker (P)	*Melanerpes erythrocephalus*
1	Yellow-bellied sapsucker (W)	*Sphurapicus varius*
1	Hairy woodpecker (P)	*Dendrocopus villosus*
1	Downy woodpecker (P)	*Dendrocopus pubescens*
1,2	Eastern kingbird (S)	*Tyrannus tyrannus*

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Appendix A-8. (cont'd)

Birds which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973) and which were observed in Trimble County, Kentucky and along the transmission corridors.

1	Great crested flycatcher (S)	*Myiarchus crinitus*
1	Eastern phoebe (P)	*Sayornis phoebe*
	Arcadian flycatcher (S)	*Empidonax virescens*
	Least flycatcher (M)	*Empidonax minimus*
1,2	Eastern wood pewee (S)	*Contopus virens*
1	Olive-sided flycatcher (M)	*Nuttalornis borealis*
	Horned lark (P)	*Eremophila alpestris*
	Tree swallow (M)	*Iridoprocne bicolor*
1	Bank swallow (S)	*Riparia riparia*
1	Rough-winged swallow (S)	*Stelgidopteryx ruficollis*
1,2	Barn swallow (S)	*Hirundo rustica*
1,2	Purple martin (S)	*Progne subis*
1	Cliff swallow (S)	*Petrochelidon pyrrhonota*
1,2	Blue jay (P)	*Cyanocitta cristata*
1,2	Common crow (P)(H)(sport & pest control)	*Corvus brachyrhynchos*
1	Carolina chickadee (P)	*Parus carolinensis*
1	Tufted titmouse (P)	*Parus bicolor*
	White-breasted nuthatch (P)	*Sitta carolinensis*
	Red-breasted nuthatch (W)	*Sitta canadensis*
	Brown creeper (W)	*Certhia familiaris*
1	House wren (S)	*Troglodytes aedon*
1	Bewick's wren (S)	*Thryomanes bewickii*
1,2	Carolina wren (S)	*Thryothorus ludovicianus*
1,2	Mockingbird (P)	*Mimus polyglottos*
1	Catbird (S)	*Dumetella carolinensis*
1	Brown thrasher (S)	*Toxostoma rufum*
1	Baltimore oriole (S)	*Icterus galbula*
1	Brown-headed cowbird (P)	*Molothrus ater*
	Rusty blackbird (P)	*Euphagus carolinus*
1,2	Common grackle (P)	*Quiscalus quiscula*
1	Scarlet tanager	*Piranga olivacea*

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V - visitant, not breeding locally
W - winter resident, absent during breeding season
1 - observed in Trimble County, Kentucky in 1975 (Water Resources Laboratory 1975)
2 - observed along proposed transmission corridors in August 1976

Appendix A-8. (cont'd)

Birds which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973) and which were observed in Trimble County, Kentucky and along the transmission corridors.

1	Summer tanager (S)	*Piranga rubra*
1,2	Cardinal (P)	*Richmondena cardinalis*
1,2	American goldfinch (P)	*Spinus tristis*
	Pine siskin (V)	*Spinus pinus*
1,2	Rufous-sided towhee (P)	*Pipilo erythrophthalmus*
1	Field sparrow (P)	*Spizella pusilla*
1	Chipping sparrow (S)	*Spizella passerina*
1,2	Song sparrow (P)	*Melospiza melodia*
1	Vesper sparrow (P)	*Pooecetes gramineus*
1,2	Indigo bunting (S)	*Passerina cryanea*
	Evening grosbeak (V)	*Hesperiphona vespertina*
	Grasshopper sparrow (S)	*Ammodramus savannarum*
	Bachman's sparrow (S)	*Aimophila aestivalis*
	Purple finch (W)	*Carpodacus purpureus*
1	Slate-colored junco (W)	*Junco hyemalis*
1	White-throated sparrow (W)	*Zonotrichia albicollis*
	Fox sparrow (W)	*Passerella iliaca*
	Swamp sparrow (W)	*Melospiza georgiana*
1	White-crowned sparrow (W)	*Zonotrichia leucophrys*
1	Rose-breasted grosbeak	*Pheucticus ludovicianus*
1	Savannah sparrow (M)	*Passerculus sandwichensis*
1	Dick cissel	*Spiza americana*
1,2	Pigeon (P)	*Columba livia*

H - hunted for sport
M - migrant
P - permanent breeding resident
R - rare and/or endangered
S - summer resident, locally breeding
V - visitant, not breeding locally
W - winter resident, absent during breeding season
1 - observed in Trimble County, Kentucky in 1975 (Water Resources Laboratory 1975)
2 - observed along proposed transmission corridors in August 1976

Appendix A-9.

Mammals which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973), in Trimble County, Kentucky (Water Resources Laboratory 1975), and along the proposed transmission corridors.

Order Marsupiala:

1,2	Virginia opossum (H)	*Didelphis virginiana*

Order Insectivora:

1	Eastern Mole	*Scalopus aquaticus*
	Smoky Shrew (?)	*Sorex fumeus*
	Least Shrew	*Cryptotis parva*
	Shorttail Shrew	*Blarina brevicauda*

Order Chiroptera:

	Keen Myotis	*Myotis keeni*
	Little Brown Myotis	*M. lucifugus*
	Indiana Myotis (R)	*M. sodalis*
	Silver Haired Bat	*Lasionycteris noctivagans*
	Eastern Pipistrel	*Pipistrellis subflavus*
	Big Brown Bat	*Eptesicus fuscus*
	Red Bat	*Lasiurus borealis*
	Hoary Bat	*L. cinereus*
	Evening Bat	*Nycticeius humeralis*

Order Carnivora:

1,2	Raccoon (H)	*Procyon lotor*
	Longtail Weasel	*M. frenata*
	Mink (T)	*M. vison*
1,2	Striped Skunk (T)	*Mephitis mephitis*
	River Otter (?)	*Lutra canadensis*
1	Red Fox (T)(H)	*Vulpes fulva*
	Gray Fox (T)	*Urocyon cinereoargenteus*
	Bobcat (?)	*Lynx rufus*

Order Rodentia:

1	Woodchuck (H)	*Marmota monax*
1	Chipmunk	*Tamias striatus*
1,2	Eastern Gray Squirrel (H)	*Sciurus carolinensis*

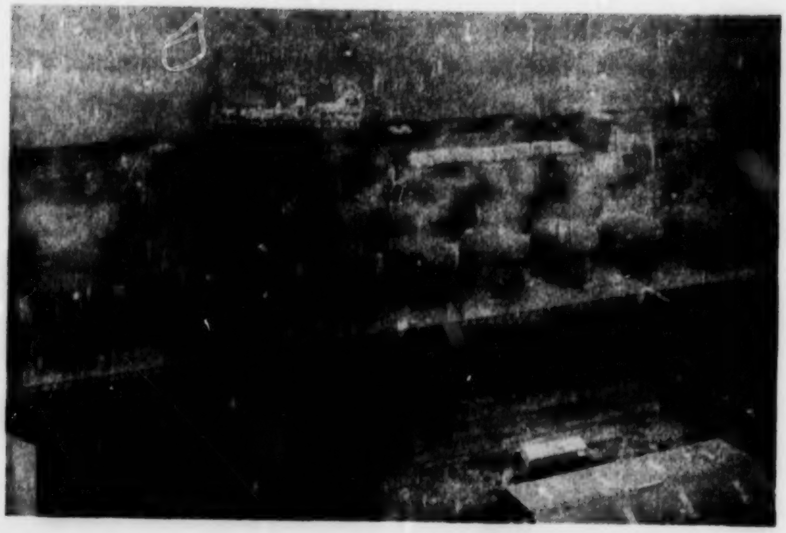
H - hunted for sport
R - rare, endangered species
T - trapped for fur
? - occurrence in study area is questionable
1 - observed in Trimble County, 1975
2 - observed along transmission corridors, August 1976

Appendix A-9. (cont'd)

Mammals which may occur in the Eagle Creek drainage (U.S. Army Engineer District, Louisville 1973), in Trimble County, Kentucky (Water Resources Laboratory 1975), and along the proposed transmission corridors.

1	Fox Squirrel (H)	*Sciurus niger*
	Flying Squirrel	*Glaucomys volans*
	Beaver (?)	*Castor canadensis*
	Eastern Harvest Mouse	*Reithrodontomys humulis*
1	White-footed Mouse	*Peromyscus leucopus*
	Deer Mouse	*Peromyscus maniculatus*
	Rice Rat (?)	*Oryzomys palustris*
	Eastern Woodrat	*Neotoma floridana*
1	Southern Bog Lemming	*Synaptomys cooperi*
1	Meadow Vole	*Microtus pennsylvanicus*
	Pine Vole	*Microtus pinetorum*
	Prairie Vole (?)	*M. orchrogaster*
	Muskrat (T)	*Ondatra zibethica*
	Norway Rat	*Rattus norvegicus*
1	House Mouse	*Mus musculus*
	Meadow Jumping Mouse	*Zapus hudsonius*
Order Lagomorphia:		
1,2	Eastern Cottontail Rabbit (H)	*Sylvilagus floridanus*
Order Artiodactyla:		
	Whitetail Deer (H)	*Odocoileus virginianus*

H - hunted for sport
R - rare, endangered species
T - trapped for fur
? - occurrence in study area is questionable
1 - observed in Trimble County, 1975
2 - observed along transmission corridors, August 1976



SECTION 3.0

PROPOSED STRUCTURES

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3.1 STATION STRUCTURES

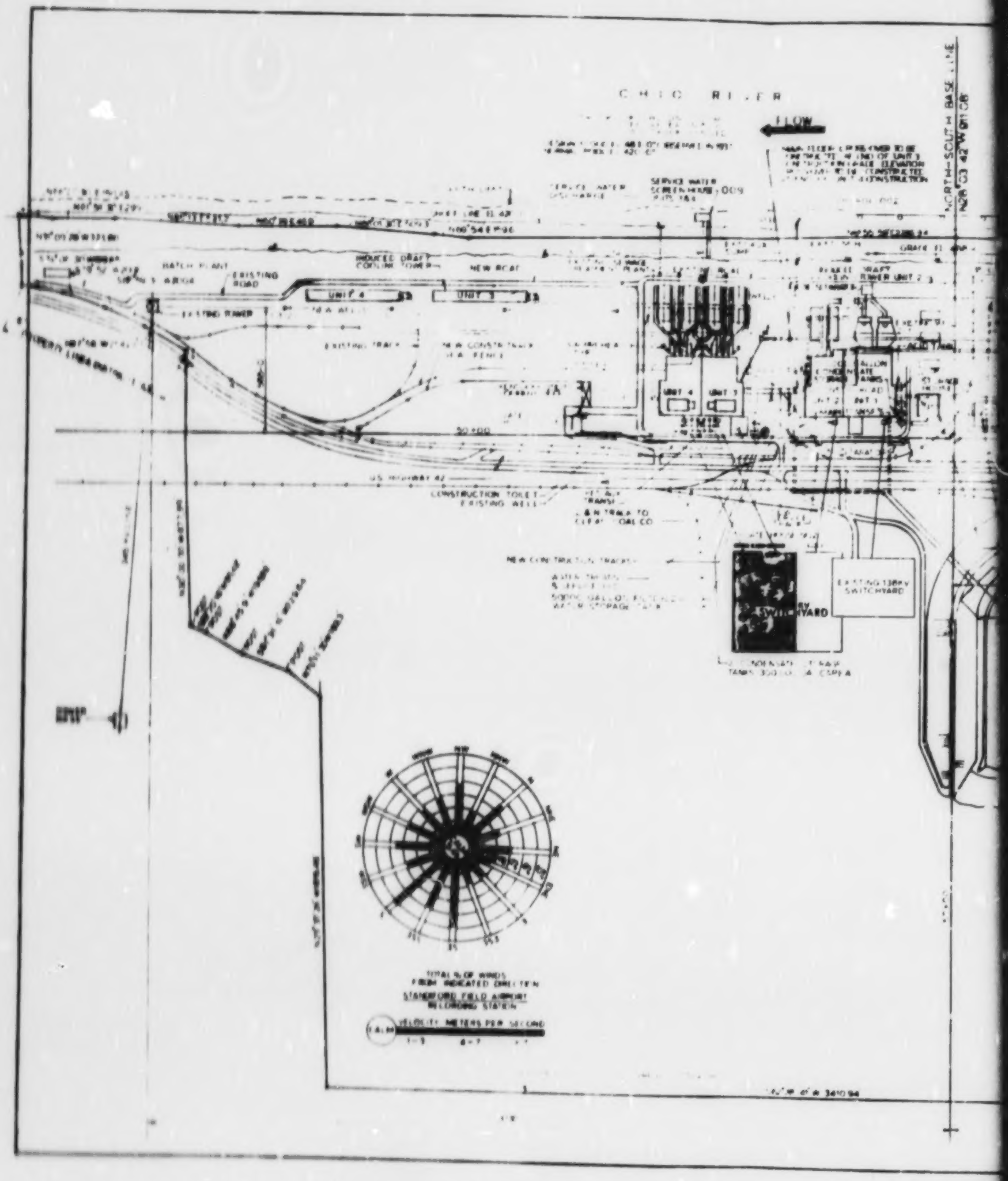
The addition of the proposed Units 3 and 4 to the existing two-unit Ghent Station will involve new construction on the existing 640 acre site. The proposed layout of the station, including existing structures, is diagramed in Figure 3.1-1. An artist's rendering of the main plant buildings is presented as Figure 3.1-2.

The main plant structure which will house the two proposed units will be similar in design to the existing main plant building for Units 1 and 2. It will be located directly next to and on the west side of the building for Units 1 and 2. The new building will house the steam electric systems consisting of the turbine generation units and the boilers. It will measure approximately 340 ft x 340 ft with a height of 231 ft.

Next to the main plant building will be the systems associated with the combustion gas. These include four air heaters, four electrostatic precipitators and a stack. The four combustion air heaters will be constructed to transfer heat from the flue gas to the air which is to be blown into the boilers. Four electrostatic precipitators will be installed and will remove 99.5 percent of the solid particles of the flue gas. The stack will be a concrete structure that will be identical to the stack for Units 1 and 2, 660 ft high with a 40 ft outside diameter at the top.

The cooling water circulation system will consist of a concrete intake screenhouse which will be located on the river bank. Three pumps at this structure will furnish water to the cooling water system. Two mechanically induced draft wet type cooling towers, one for each unit, will be constructed to cool the circulating water. Associated piping for this cooling water system will be constructed to transport water through the system and to remove cooling tower blowdown to the existing ash pond. There will be two discharge structures associated with the cooling water circulation system. These include the existing ash pond discharge structure (001) and a proposed plant service water discharge structure (008).

The fuel handling system for Units 3 and 4 will involve expansion of the existing coal storage yard eastward by approximately 13.3 acres. It will be surrounded by a drainage ditch to remove run-off water to a settling basin. The coal crusher


OHIO RIVER
FLOW
NORTH–SOUTH BASE LINE
N26°03'42"W
SERVICE WATER DISCHARGE
SERVICE WATER SCREEN HOUSE 009
BATCH PLANT
EXISTING ROAD
INDUCED DRAFT COOLING TOWER
NEW ROAD
UNIT 4
UNIT 3
EXISTING TOWER
EXISTING TRACK
NEW CONSTRUCTION FENCE
GRADE EL
UNIT 4
UNIT 3
UNIT 2
UNIT 1
50+00
U.S. HIGHWAY 42
CONSTRUCTION TOILET
EXISTING WELL
L&N TRACK TO CLEAR COAL CO.
NEW CONSTRUCTION TRACKS
WATER TREATMENT
50,000 GALLON POTENTIAL WATER STORAGE TANK
SWITCHYARD
EXISTING 138KV SWITCHYARD
CONDENSATE STORAGE TANKS
TOTAL % OF WINDS FROM INDICATED DIRECTION
STANDIFORD FIELD AIRPORT RECORDING STATION
CALM
VELOCITY METERS PER SECOND
1–3
4–7
>7

A

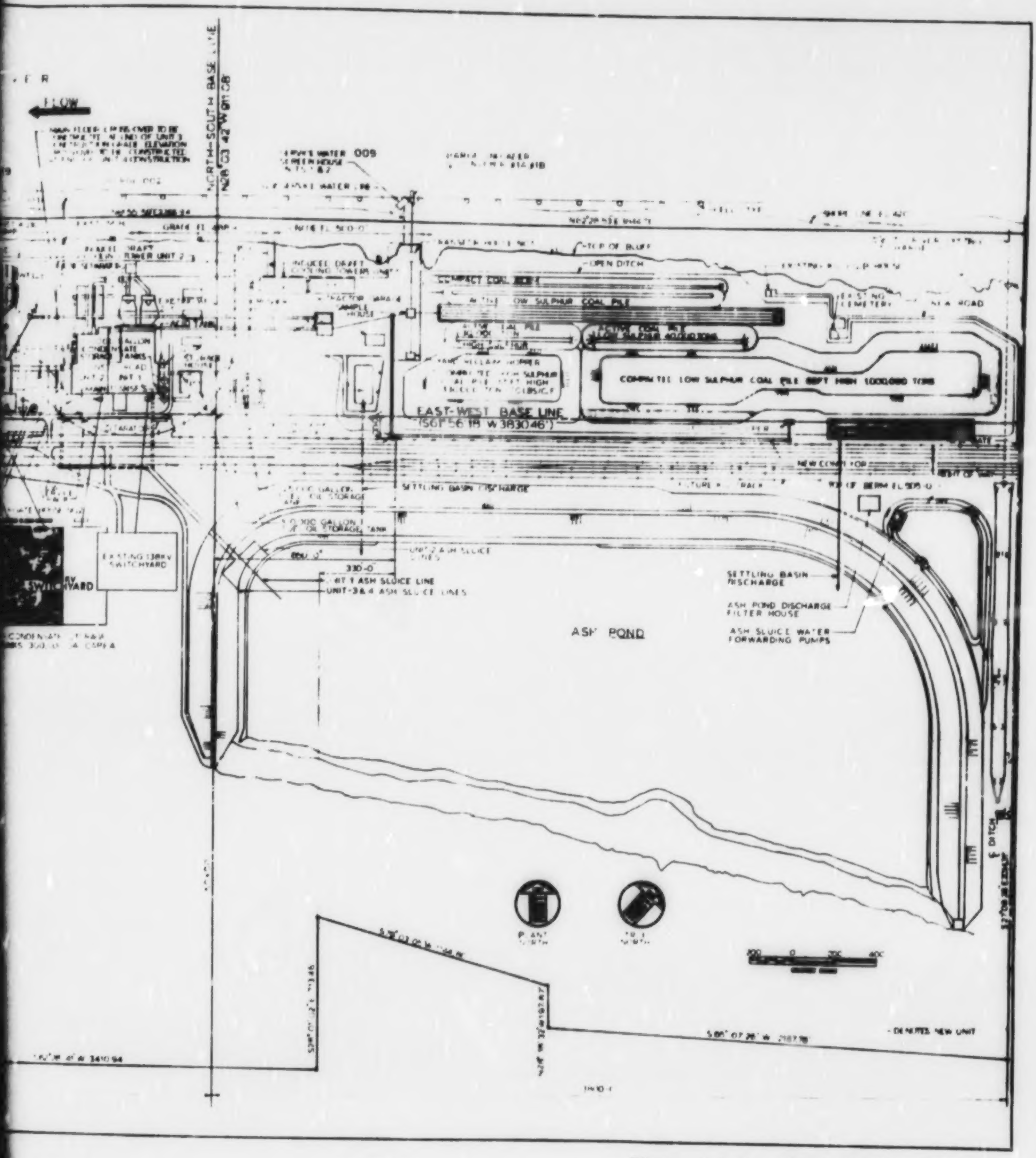


Figure 3.1-1. Ghent Station layout.

B

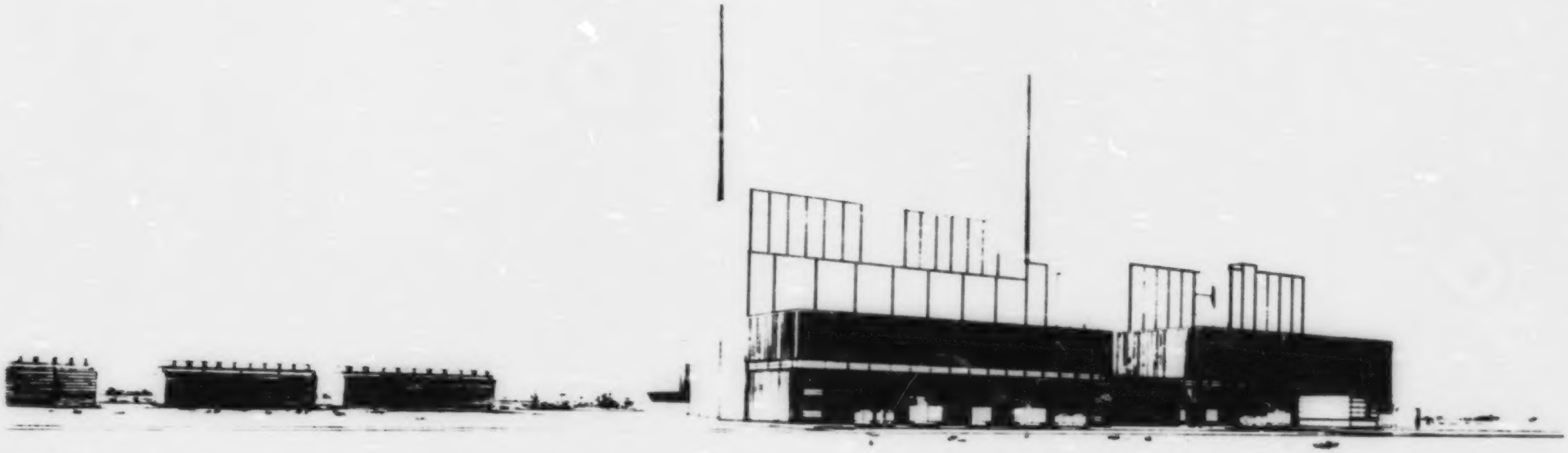


Figure 3.1-2. Proposed Ghent Station.

house will be enlarged by 4800 sq ft. It will be connected to Units 3 and 4 by a conveyor system 2400 ft in length.

The electrical switchyard will be expanded by approximately 138,000 sq ft. It will enclose the main power transformers and the auxiliary transformers for Units 3 and 4. A 345 kV transmission line associated with the construction of Unit 4 will be constructed from near the switchyard to a substation which will be located approximately 5 miles west of Frankfort.

Other construction associated with Units 3 and 4 are a roadway servicing the cooling towers, office building, settling basin for coal yard drainage with a discharge pipe connected to the ash pond, two condensate storage tanks, a machine shop, and a water treatment service building.

3.2 STEAM-ELECTRIC SYSTEM

3.2.1 Boiler

Each unit will have one boiler, manufactured by Foster-Wheeler. The boilers are coal-fired and designed to burn from 0.6 to 3.0 percent sulfur coal. They have a maximum continuous rate of steam delivery of 3,800,000 pounds per hour.

3.2.2 Turbine Generation Unit

The turbine generating units design by General Electric are guaranteed to provide 511 MW per unit at 1.5-inch mercury back pressure. Expected turbine (design) capability at 1.5-inch mercury back pressure with 0% makeup and valves wide open with 5% overpressure is 556 MW. This unit is generally referred to as a 500 MW unit.

3.3 PLANT WATER USE AND WASTE WATER TREATMENT SYSTEM

This section presents the proposed breakdown of water usage of the Ghent Station upon completion of Units 3 and 4. Descriptions of the plant cooling water system, the plant boiler and domestic water supply systems and the waste water system are given. Two structures will be utilized in the discharge of all waste streams resulting from the operation of Units 3 and 4. These are the plant service water discharge (008) and the ash pond discharge structures (001). Water flow diagrams (Figure 3.3-1) are presented to give an overall picture of the water usage and flows associated with the operation of the Ghent Station.

3.3.1 Plant Cooling Water System

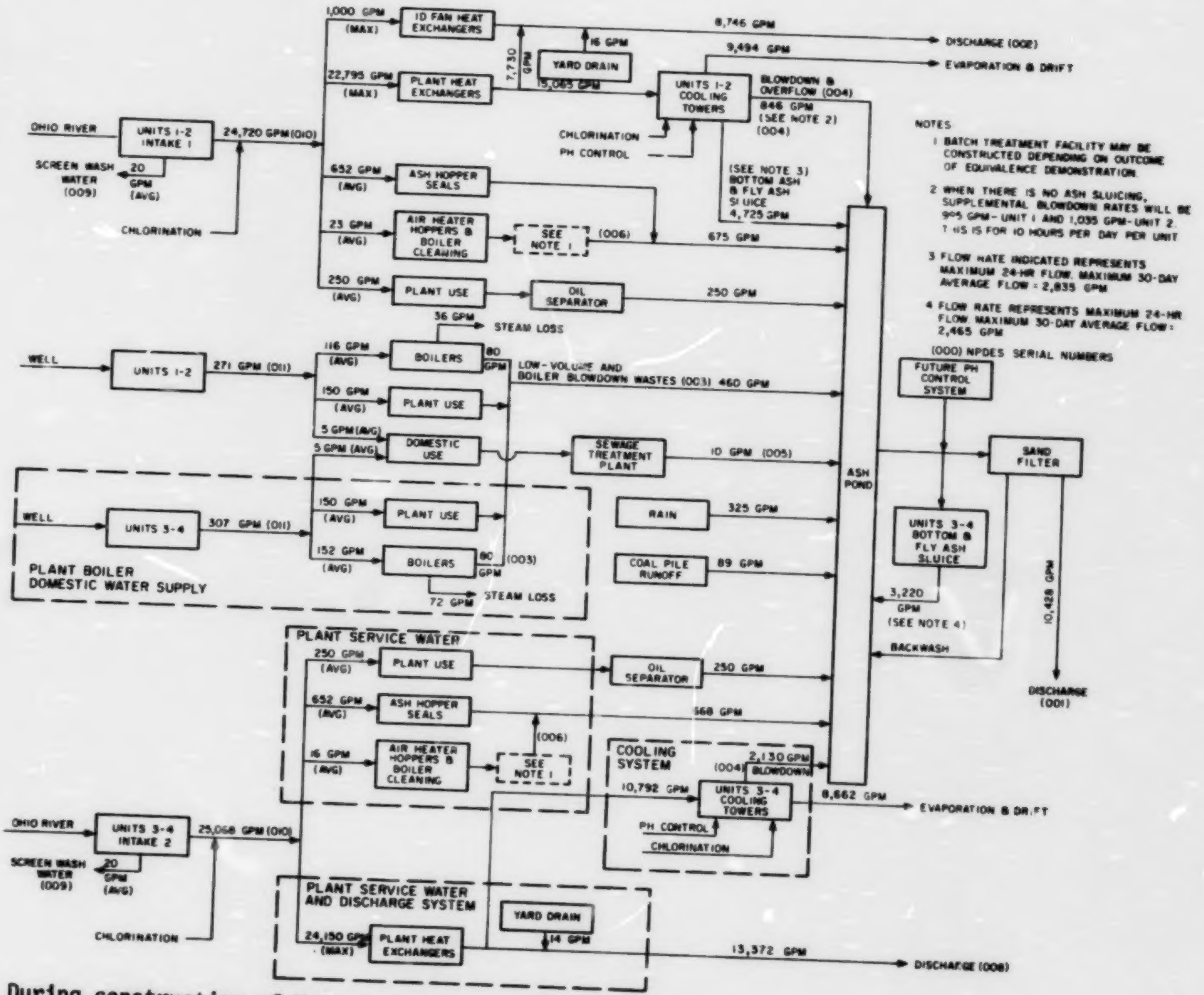
The plant cooling water system consists of the cooling water intake, condenser cooling system, cooling tower and the plant service water and discharge systems. The water flow diagram (Figure 3.3-2) is a further breakdown of the Unit 3 and 4 cooling tower and plant heat exchanger blocks of Figure 3.1-1.

3.3.1.1 Plant Cooling Water Intake

Water which will be utilized as make-up water for the condenser cooling and the plant service water systems will be obtained from the Ohio River. To obtain this water, the construction of an intake structure on the south bank of the Ohio River, near the main plant building for Units 3 and 4, is proposed. It will consist of a concrete screenhouse 36 ft wide, 46 ft 2 in long and 63 ft in height above normal pool elevation.

Water will be supplied by three full-size (one a spare) low pressure service pumps, each with a capacity of 21,000 gpm. Thus, for Units 3 and 4, the total pump capacity will be a maximum of 42,000 gpm. The average intake rate under full generation will be approximately 25,068 gpm for both units (see Figure 3.3-1).

The water will pass through traveling screens, which will remove debris. The debris will be automatically collected in a trash basket and periodically removed for disposal. The intake opening has been designed so that at the maximum pump



NOTES

1 BATCH TREATMENT FACILITY MAY BE CONSTRUCTED DEPENDING ON OUTCOME OF EQUIVALENCE DEMONSTRATION.

2 WHEN THERE IS NO ASH SLUICING, SUPPLEMENTAL BLOWDOWN RATES WILL BE 995 GPM - UNIT 1 AND 1,035 GPM - UNIT 2. THIS IS FOR 10 HOURS PER DAY PER UNIT

3 FLOW RATE INDICATED REPRESENTS MAXIMUM 24-HR FLOW. MAXIMUM 30-DAY AVERAGE FLOW = 2,835 GPM

4 FLOW RATE REPRESENTS MAXIMUM 24-HR FLOW. MAXIMUM 30-DAY AVERAGE FLOW = 2,465 GPM

(000) NPDES SERIAL NUMBERS

Note: During construction of Units 3 and 4, construction runoff will be routed to the ash pond.

Figure 3.3-1. Ghent Station water use diagram.

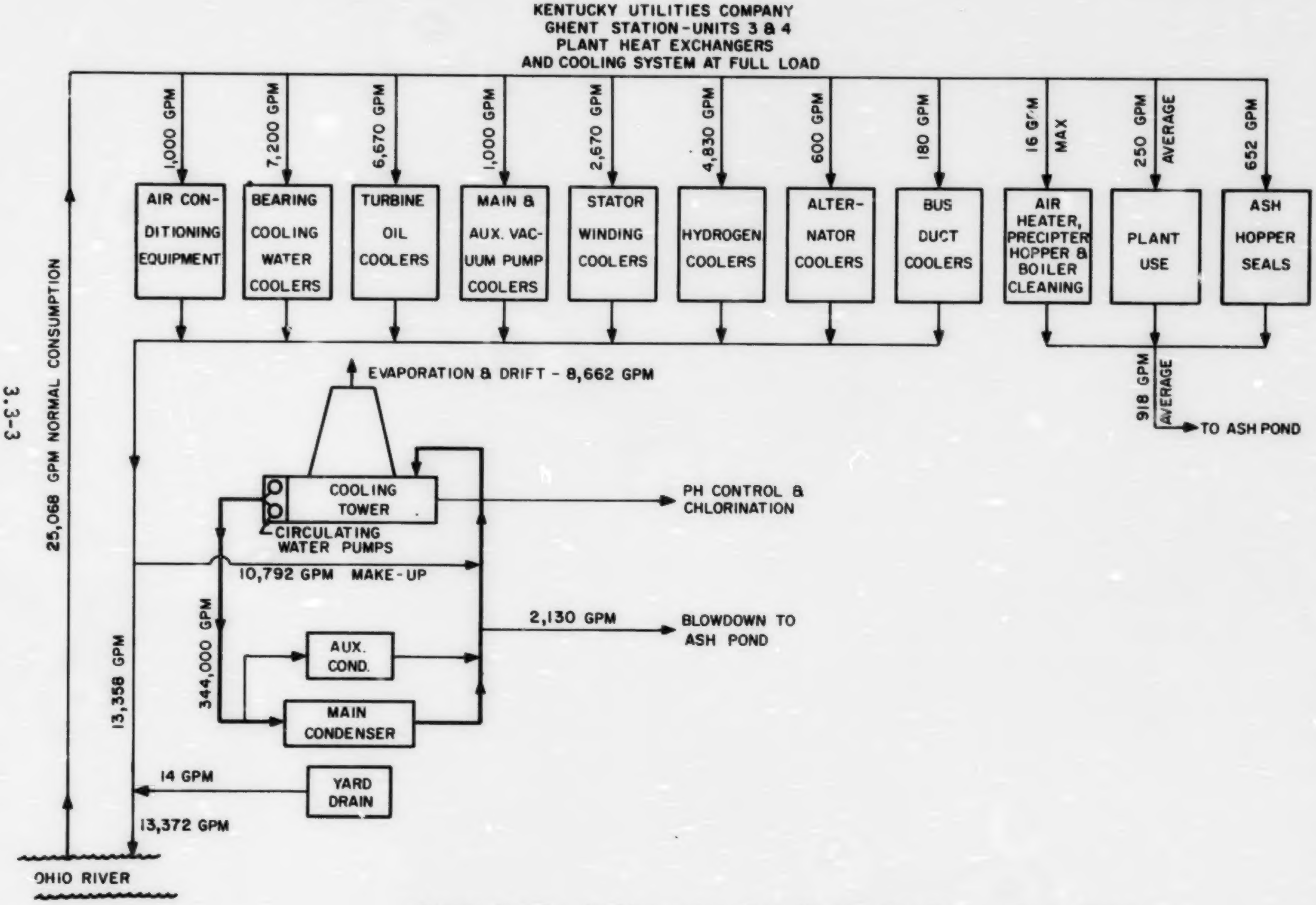


Figure 3.3-2. Cooling water flow diagram for Ghent Units 3 and 4.

rate, the velocity of the water through the bar grills and in the forebay upstream of the traveling screen will be 0.48 ft/sec. Figure 3.3-3 shows the screenhouse plan.

3.3.1.2 Condenser Cooling System

The condenser system in a steam electric power plant maintains a low turbine exhaust pressure by condensing the steam leaving the turbine at a temperature corresponding to vacuum conditions. This provides a high cycle efficiency and also recovers the condensate for return to the cycle. The proposed condenser system utilizes a surface type shell and tube heat exchangers. The condenser tube material is arsenical copper.

Cooling water to be circulated through the heat condensers will be used in a closed cycle with the cooling towers. Of the 25,068 gpm average rate of water intake from the Ohio River, approximately 10,792 gom will be used as make-up water for the condenser cooling system. This make-up water is used to replace losses due to cooling tower drift, evaporation and blowdown. Total flows passing through the condensers for cooling will average 344,000 gpm and will involve an estimated five cycles of concentration (see Figure 3.3-2).

3.3.1.3 Cooling Towers

Condenser cooling water for Units 3 and 4 will be cooled by two mechanically induced draft, wet type cooling towers, one for each unit. Each tower will be able to cool up to 172,000 gpm of water with a 29.2F cooling range, 11.4F approach temperature and 79F design wet-bulb temperature. Each tower will dissipate to the atmosphere approximately 4514 BTU/KW or about 2510 million BTU/hr (Table 3.3-1).

Chlorination will be used in compliance with the draft NPDES permit to inhibit growth of fouling organisms in the condenser cooling system. Also a pH control system will be constructed to maintain a proper pH of cooling system circulation water (see Section 8).

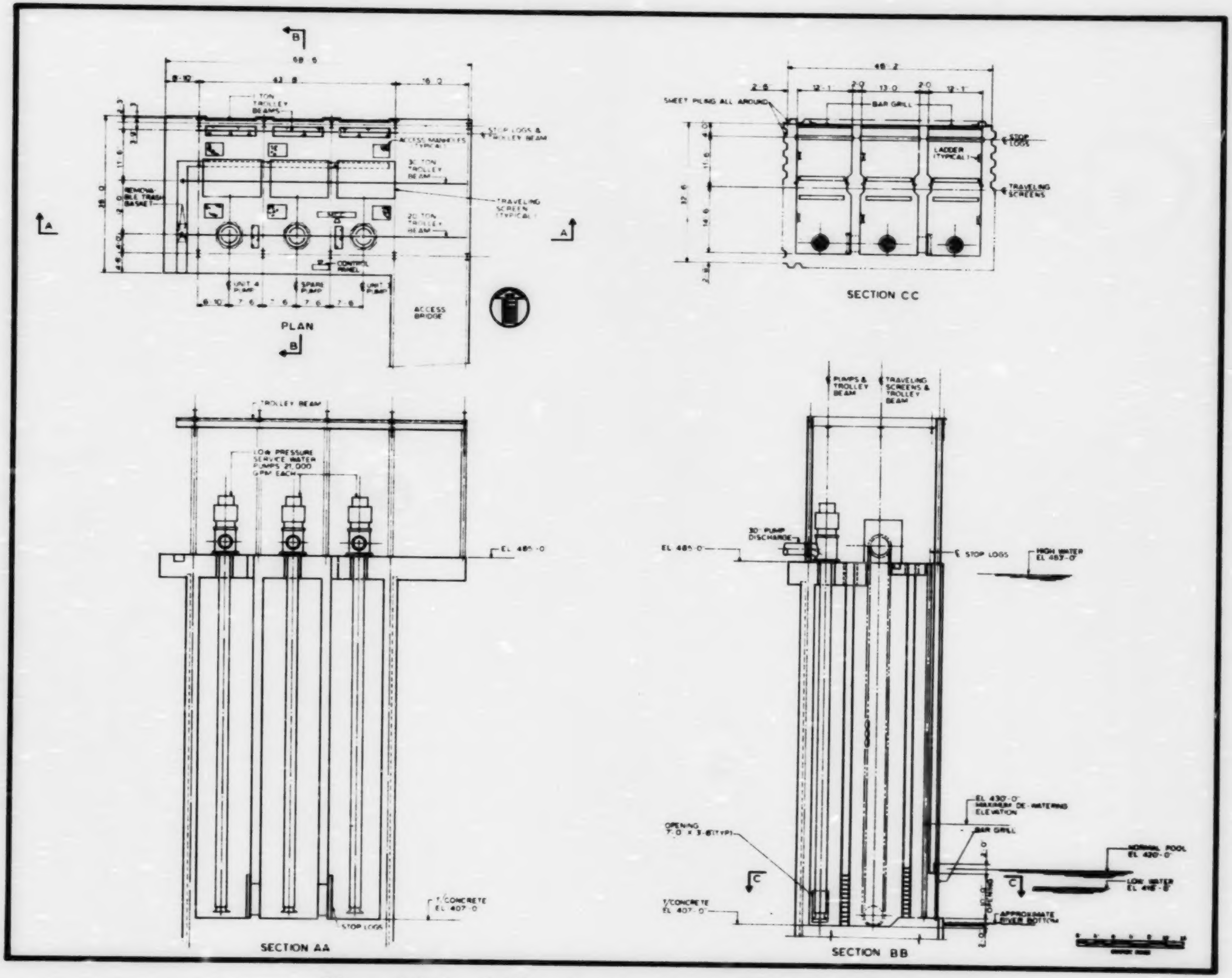


Figure 3.3-3 Intake structure design for Ghent Units 3 and 4.

Table 3.3-1

Cooling Tower Parameters
Ghent Station, Units 3 and 4
(Typical for each unit)

Turbine-Generator Load	Heat Rejection to Cooling Tower (BTU/hr x 10^6)	Cooling Tower Evap. (gal/min)	Tower** Drift Losses (gal/min)	Tower Inlet Water Temperature (F)	Tower Outlet Water Temperature (F)	Remarks
(1) Capability (VWO + 5% OP)*	2510	4317	14	119.6	90.4	Design operating conditions
(2) Guarantee	2300	3962	14	116.6	89.8	Guaranteed load at design weather conditions
(3) Capability	2510	4362	14	121.2	92	Max. instantaneous conditions expected
(4) Capability	2510	4295	14	119.2	90	Max. 24-hr average conditions expected
(5) 76.58% Capacity Factor	1922	3182	14	105.9	83.5	Max. 30-day average conditions expected

Note: Based on 172,000 gpm flow to cooling tower, 11.4°F approach, 79°F wet-bulb temperatures and 29.2°F design cooling range.

* VWO + 5% OP - Values wide open plus 5% overpressure.

** Two-pass blade-type mist eliminators with closer blade spacing will be furnished to achieve the guaranteed maximum drift loss of 0.008%.

3.3.1.4 Plant Service Water and Discharge Systems

The plant service water system will supply water to be used as coolant for the different heat exchangers essential to the operation of the proposed generating units such as the turbine oil coolers, hydrogen coolers, alternator coolers and bearing cooling water heat exchangers. In addition, part of the service water will be used for other miscellaneous uses, such as backwashing the service water strainers and traveling screens, for general cleaning and fire protection.

Approximately 25,068 gpm will be circulated through this system for Units 3 and 4. That which is in excess of cooling tower make-up requirements will be discharged back into the Ohio River. The rate of the discharge flow will average 13,372 gpm (see Figure 3.3-2). The discharge pipe base will be located approximately 6 ft below normal pool elevation. The temperature rise above ambient at the point of discharge may be as high as 10F.

Due to periodic biocide treatment of this sytem, chlorine may at times be discharged. The draft NPDES permit as presented in Section 8 states that the total residual chlorine will not exceed 0.3 mg/ℓ instantaneous or 0.2 mg/ℓ one hour average at the point of discharge. The ability to meet this limitation is anticipated. If it is not, dechlorination equipment will be added.*

3.3.2 Plant Boiler and Domestic Water Supply

Plant domestic and demineralizer water will be obtained from on-site wells (see Figure 3.3-1). The average rate of water use for Units 3 and 4 will be 307 gpm. The maximum use rate is expected to be 450 gpm. This usage is approximately the same as for Units 1 and 2. Groundwater requirements for the complete station will be supplied by two 200 gpm wells, one 400 gpm well and a fourth well rated at approximately 450 gpm.

Plant boilers for Units 3 and 4, at full load, will require 152 gpm of make-up water. Of the 152 gpm, 80 gpm will replace water loss due to boiler blowdown and 70 gpm will replace normal steam loss.

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* The company has the option, as biological toxicity data become available, to submit a demonstration showing that discharge of higher levels of chlorine are consistent with Kentucky Water Quality Standards.

Boiler feed water needs to be high purity. For this reason, well water is circulated through a demineralizer system before being used. This system consists of regenerative cation and anion exchangers that remove the mineral salts in the water.

3.3.3 Waste Water Treatment System

The waste water treatment system is made up of the following: (1) particulate settling system, (2) oily waste handling system, (3) low volume waste system, and (4) treated boiler and metal cleaning if necessary. All waste water will be routed to the ash pond.

3.3.3.1 Particulate Settling and Discharge System

Waste streams treated under this system include those where particulate matter (i.e., total settleable solids and total suspended solids) constitutes the objectionable contaminant. Treatment provided under this system consists of settling, using the existing Units 1 and 2 ash pond. Waste streams under this classification will be routed directly through the present ash pond. Included among these streams are the following: (1) run-off from the present and future coal storage pile, (2) floor drains from the transfer house, sample yard and yard reclaim hopper--all of which contain coal dust, (3) backwash streams from service water strainers, (4) cooling tower basin drains, (5) drains and overflow from ash hoppers, (6) pyrites transfer hopper overflow, (7) filter backwash, and (8) other miscellaneous drains that may fall under this category.

3.3.3.2 Oily Waste Handling System

Waste streams processed under this system include those susceptible to oil and grease contamination. These include turbine room drains, transformer area drains, oil handling equipment and area drains, miscellaneous floor drains, and other drains which may be classified under this category. These drains will be treated by routing them through an oil separator. The oil separator effluent will, in turn, be pumped into the present ash pond whose spillway is equipped with a skimmer. With this scheme, should oil or grease escape the oil separator, it will further be confined within the ash pond prevented from being released into the Ohio River. The captured oil and grease will be applied to the coal in the coal storage area for later combustion.

3.3.3.3 Low-Volume and the Boiler and Metal Cleaning Waste Systems

The low-volume wastes, consisting of the demineralizer regenerant wastes, softener regenerant wastes, laboratory and sampling drains, selected miscellaneous floor and equipment drains and boiler blowdown will be routed into the ash pond.

The metal cleaning wastes, namely the boiler fireside and tubeside cleaning wastes, the air heater wash water and the precipitator hopper cleaning wastes will be routed to the ash pond. Pretreatment of these wastes will consist of a batch treatment facility which will be constructed to neutralize and chemically precipitate the wastes.*

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* Dependent on outcome of equivalence demonstration.

At the mine site, the coal that will be used for Units 3 and 4 will be crushed to the size of approximately 2 in diameter, of which no more than 35 percent shall be classified as (1/4 in x 0) fines. All reasonable means to remove extraneous matter such as metal objects and any partings present in the coal will be used to obtain the cleanest coal possible.

3.4.3 Fuel Delivery and Storage

The final delivery of coal to the plant will be by barge. The present barge unloading facilities for Units 1 and 2 will be sufficient for the increased volume required by Units 3 and 4. As Units 3 and 4 become operational, it is expected that the unloading facilities will operate almost continuously and unload approximately 48 to 72 barges of coal per week.

The coal will then be transported from the unloading facility via the existing conveyor system to the coal storage area. The existing coal storage area will be increased by 13.3 acres to accommodate the added volume required by Units 3 and 4. Since a majority of the Ghent Station units (2 through 4) will be burning low sulfur coal, the front two-thirds of the storage yard will contain the low sulfur coal while the back one-third of the storage yard will contain the higher sulfur coal which is presently burned in Unit 1.

The crusher house will be expanded by 4800 sq ft and will be connected to Units 3 and 4 by a conveyor system 2400 ft in length.

3.4 FUEL

3.4.1 Coal

Coal, which is to be used for Units 3 and 4, is expected to be supplied from East Kentucky sources, with some possibility of 20 to 30 percent of the coal coming from West Virginia. The coal will be trucked approximately 25 to 100 miles and loaded on 1500 ton barges at available river terminals (presently Ashland, Kentucky is a consideration). Barges will travel approximately 220 river miles downstream to the Ghent Plant coal unloading facilities. Under normal operation (60 percent load), Units 3 and 4 will burn a total of 2.4 million tons of coal per year. This will require 1600 barge loads per year to supply the coal. Kentucky Utilities Company has a possibility of three different suppliers for the above required coal requirements. If is the intention of Kentucky Utilities to have a minimum 15-year contract with renewable option for 15 more years to purchase the required amount of low sulfur coal for Units 3 and 4.

3.4.2 Specifications

It is anticipated that the sulfur content of the coal used for Units 3 and 4 will meet government requirements. Such requirements currently are that the ratio of the percent sulfur by weight to the calorific value of the coal in BTU per pound shall not exceed .00006. An example of shipment in compliance is:

12,200 BTU/lbs and 0.71% sulfur

$$\frac{0.71\%}{12,200} = .000058$$

Example of shipment not in compliance:

11,700 BTU/lbs and 0.83% sulfur

$$\frac{0.83\%}{11,700} = .000071$$

Each shipment of coal will be tested to insure that the quality will comply with state and federal standards. Coal which does not meet standards will not be burned.

3.5 ASH AND FLY ASH DISPOSAL SYSTEM

Unlike the method used to transport bottom and fly ash from Units 1 and 2 incorporating cooling tower blowdown, a recirculating ash sluice system is planned for Units 3 and 4. This system will draw discharge water from the ash pond for the purpose of transporting bottom and fly ash from Units 3 and 4 back to the ash pond. The daily average flow rate will be 3220 gpm.

The ash pond capacity is estimated at 200 million cubic feet. The earliest probable date that the ash pond would reach capacity is 1992, nine years after Unit 4 becomes operational, assuming that all ash produced by Units 1 through 4 is disposed of in the pond.

Since fly ash is now recognized as a beneficial additive in concrete, cement block and paving materials, it is very probable that a market for fly ash from the Ghent Station will be developed prior to 1992. Such sales of fly ash could extend the lifetime of the ash pond as is shown in Table 3.5-1.

Table 3.5-1

Ash Pond Storage Capacity Analysis*

Years of Operation	All Ash to Pond (ft^3)	Fly Ash Sold if Market Develops (ft^3)	Total Ash to Pond if Units 3&4 Fly Ash Disposed of Offsite (ft^3)
1974 - 1980	30,499,000	8,198,000	30,499,000
1983	84,649,000	21,364,000	72,987,000
1988	156,915,000	37,320,000	116,584,000
1993	222,855,000	51,759,000	155,300,000
1998	278,298,000	63,702,000	186,117,000
2003	322,372,000	73,149,000	210,101,000
2008	353,309,000	79,659,000	225,826,000
2013	369,056,000	82,605,000	230,806,000
2017	374,373,000	83,505,000	231,707,000

* Based on the following coal specifications (as received).

Heating value (BTU/lb)	Average ash content
Units 1 & 2 - 11,000	Unit 1 - 11.6%
Units 3 & 4 - 12,200	Units 2,3,4 - 10%

In anticipation of future markets for dry fly ash, a 1000 ton capacity storage silo to facilitate the direct loading of ash into covered trucks will be installed at Units 3 and 4.

If markets for dry fly ash are not available, additional ash disposal areas would be sought prior to exceeding the capacity of the existing ash pond. These disposal areas are to be approved by the State of Kentucky and the EPA Region IV. The new ash disposal areas would either receive ash dredged from the existing pond or ash transported directly from the individual units.

The method of transporting the ash to an offsite disposal area will depend upon the distance from the plant and the geography of both the route and the site. If the new disposal site is located in an area that makes it uneconomical to extend the existing ash pipelines, then the ash will be hauled to the site in covered trucks. However, if trucks are used then both the bottom ash and fly ash transport systems would require extensive retrofitting. Regardless of the ash transport method employed, all ash handling and disposal techniques would be conducted in an environmentally acceptable manner.

The retention time of the ash pond upon completion of Units 3 and 4 is estimated to be 6.9 days (considering total inputs to equal 30.41 cfs under full load and an average water content of the pond as 18 million ft^3).

The outfall of the ash pond is directed to a second smaller settling basin located at the north corner. It is from this second settling basin that water will be recirculated for the Unit 3 and 4 ash sluice system. The effluent of the second settling basin will be directed through a final sand filter and then discharged into the Ohio River via an existing 72-in diameter pipe structure. Maximum flow rate is expected to be 10,428 gpm.

3.6 ATMOSPHERIC EMISSIONS

3.6.1 Introduction

The intent of this study is to predict the ground level concentrations of sulfur dioxide (SO_2) and total suspended particulates (TSP) which will be the result of the operation of the proposed Ghent Units 3 and 4. These predictions are important in order to determine whether the proposed units will meet applicable state and federal ambient air and significant air quality deterioration standards. State and federal ambient air standards determine the maximum sulfur dioxide (SO_2) and total suspended particulates (TSP) concentrations allowable in terms of maximum 3 hr, 24 hr and annual averages (Table 3.6-1). Significant air quality deterioration standards determine the increment increase of SO_2 and TSP allowable from sources occurring since 1 January 1975 (Table 3.6-2).

An important factor involved with predictive air modeling is the contribution that other sources make to the local ground level contaminant concentrations near the Ghent Station. Another factor is the contribution that the proposed units at Ghent will make on local areas near other sources. These factors are computed accounting for large sources within a 24 km radius of the Ghent Station. Figure 3.6-1 shows the location of three other sources considered in the modeling:

OVEC's Clifty Creek Plant - existing
LG&E's Wises Landing Plant - proposed
CG&E's East Bend Plant - proposed

Normally, when predictive air models are used to determine air emission at any site, it is desirable to calibrate the model with measured data. There are only two emission monitoring stations available in the Ghent area and therefore data is insufficient to calibrate the models.

Ground-level concentrations were calculated employing dispersion analysis via the EPA 24-hr computer model and the EPA terrain computer model which is more applicable in the vicinity of an emission source where complex terrain features exist. These models are employed because of the wide application by regulatory agencies in diffusion modeling analysis.

Table 3.6-1

Existing Federal and State Air Quality Standards

Pollutant	Annual Average	Annual Geometric Mean	24 hr Max.	3 hr Max.
		Primary Standards		
TSP	n.a.	75 μg/m³	260 μg/m³	n.a.
SO_2	80 μg/m³	n.a.	365 μg/m³	n.a.
		Secondary Standards		
TSP	n.a.	60 μg/m³	150 μg/m³	n.a.
SO_2	n.a.	n.a.	n.a.	1300 μg/m³

Source: Kentucky Department for Natural Resources and Environmental Protection, 1975.

Table 3.6-2

Significant Deterioration Increment Standards For Class II Designations

Pollutant	μg/m³
TSP	
Annual geometric mean	10
24 hr maximum	20
SO_2	
Annual arithmetic mean	15
24 hr maximum	100
3 hr maximum	700

Source: U. S. Environmental Protection Agency, 1974.

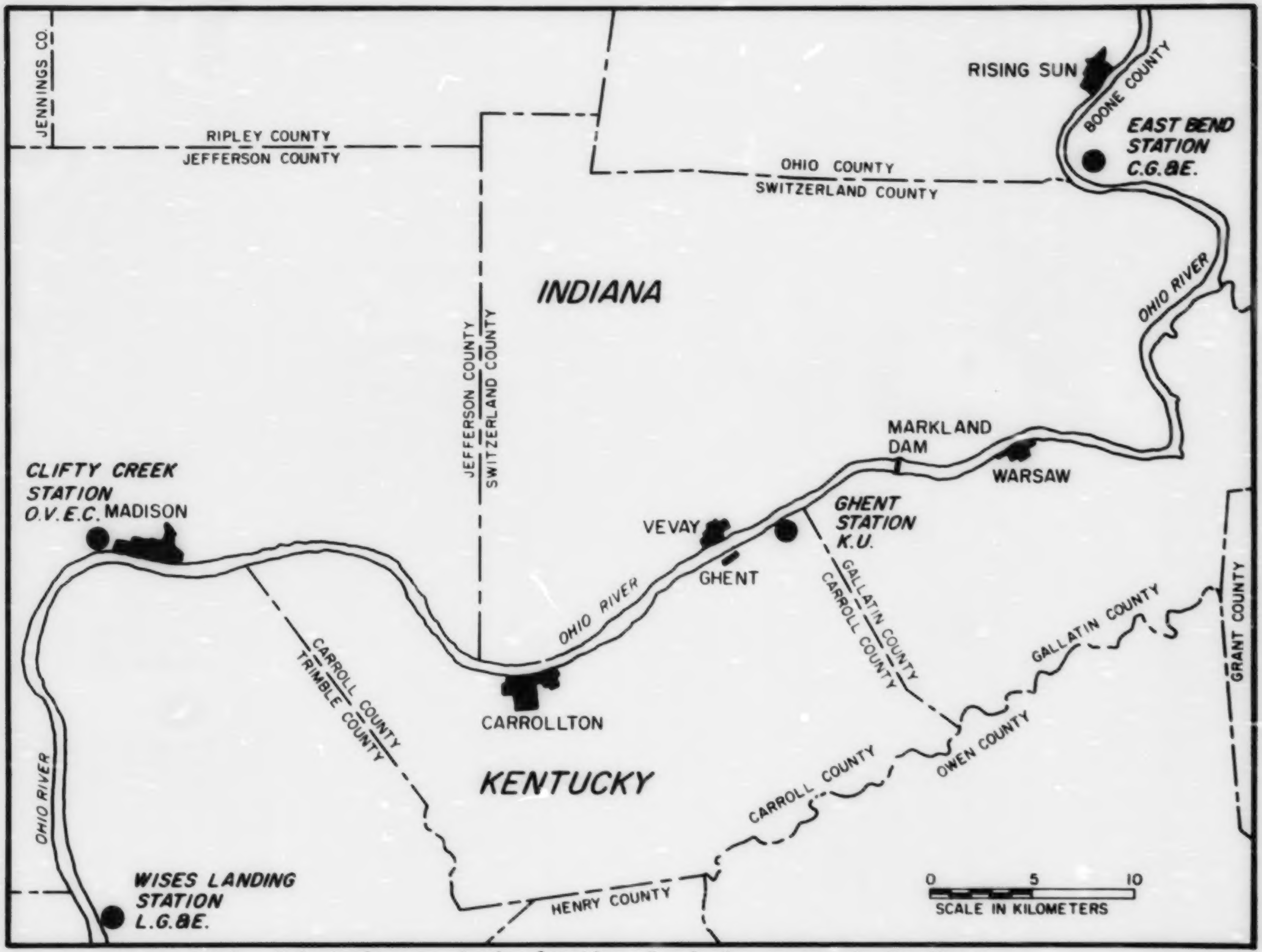


Figure 3.6-1. Orientation map showing location of emission sources in the Ghent region. (Clifty Creek Station, Wises Landing Station, Ghent Station and East Bend Station)

3.6.2 Computer Modeling Programs

3.6.2.1 PTMAX

The first program, called PTMAX, is used to determine the distances from a single point source at which maximum 10-min average ground-level pollutant concentrations may be expected. These distances are computed for various combinations of wind speed and atmospheric stability. Since wind direction is not considered by the program, the resultant distances are direction-independent. For certain combinations of wind speed, stability and emission source operating parameters, the computational techniques and assumptions included in the program are not valid, and a message is automatically printed explaining why either no calculation was attempted or why the output shown should be treated with suspicion (U. S. Department of Agriculture 1976).

3.6.2.2 CRS-1

The CRS-1 program takes 1964 meteorological data from Louisville, Kentucky and Dayton, Ohio, combines it with emission source values, and produces concentrations from five points located concentrically (at .8, 1.5, 3.0, 4.2 and 6.0 km and at 10° azimuths). These five locations that were found to have maximum concentrations were derived from the PTMAX program. A resultant from CRS-1 which is important for the next program to be discussed is an output giving the worst meteorological days causing the greatest emission concentrations within a certain location.

3.6.2.3 PTMTP-W

Having determined through the CRS-1 program the specific days on which highest 24-hr concentrations occur, the program designated PTMTP-W is run. Essentially, PTMTP-W offers a way of refining the results obtained from CRS-1 for specific 1 hr and 24 hr periods of interest. The same emission sources used in CRS-1 can be used in PTMTP-W. In PTMTP-W, however, they are placed at their actual locations. Furthermore, there is much greater latitude in selecting receptor points at which to calculate concentrations. Any point can be treated as a receptor, so that locations where maximum 3 hr and 24 hr concentrations would be expected to occur can be used.

The output from PTMTP-W consists of a tabular listing showing each 1 hr average concentration and the total 24 hr average concentration at each receptor selection. In addition, that portion of the total concentration which is contributed by each individual emission source at each receptor is also given. As many days as desired can be considered by rerunning the program for each individual day. Usually the only days of interest are those that are associated with the highest overall 3 hr and 24 hr concentrations during the year, or the days with highest concentrations at particular points of concern.

3.6.2.4 Terrain Model

The Terrain Model is used to calculate the maximum annual ground-level concentration that may be expected from a source or sources. The Terrain Model uses a fixed circular network of receptors located along radials from the center of the plot (but with variable scale), with concentrations outputed on the computer printer in map form. The Terrain Model can also consider the effect of terrain on ground level concentrations by assigning each receptor with a corresponding elevation. Because of the complex terrain surrounding the units, the Terrain Model was determined to be the appropriate model for predicting annual concentrations (U. S. Department of Agriculture 1976).

3.6.3 Input Data

The input parameters used in the models were obtained partly from Kentucky Utilities and partly from EPA Region IV Air Quality Section. Close contact was kept with EPA Region IV Air Quality Section with regards to the execution of the models. To a large extent, their rationale was the determining factor for the use of certain parameters.

3.6.3.1 Meteorological Data

For the 3 hr and 24 hr average concentration predictions, 1964 Louisville/Dayton meteorological data was utilized. This was because 1964 was the most recent year in which complete hourly data for this area is available. For prediction of present day average annual ambient conditions, the 1974 Covington Star Rose meteorological data was used. This set of data presented the most recent information that was on an annual basis. For the remainder of the annual average ground-level concentration moedling 1964-1969 Louisville five year average, Star Rose data was used because of its long-term statistical accuracy.

3.6.3.2 Source Parameters

Table 3.6-3 shows the parameters from each source used to run both the short-term program (PTMTP-W) and the long-term program (Terrain Model).

Table 3.6-3

Stack Parameters for Units at 95% Load

	KU		OVEC		LG&E		CG&E	
	Ghent Plant		Clifty Creek Plant		Wises Landing Plant		East Bend Plant	
	1	2	1	2	1	2	1	2
Stack height (m) (ft)	201 (659.4)	201 (659.4)	211.9 (695.2)	211.9 (695.2)	244.2 (801.2)	244.2 (801.2)	202 (662.7)	202 (662.7)
Emission Rate of SO_2 (g/sec)	4082.0	1365.0	847.76	847.76	2000.0 (1431.5)*	1466.7 (1049.8)*	821.5	821.5
Plant Elevation (m) (ft)	149.0 (489)	149.0 (489)	140.2 (460)	140.2 (460)	144.8 (475)	144.8 (475)	158.5 (520)	158.5 (520)
Stack Temp. (K)	418.6	410.8	421.9	421.9	389	389	423	423
Diameter (m)	9.1	9.1	7.1	7.1	9.0	9.0	6.3	6.3
Exit Velocity (m/sec)	22.9	23.2	33.2	33.2	20.7	20.7	33.5	33.5

* These values reflect the latest emission rates of SO_2 for Wises Landing Plant. The original values (2000 g/sec and 1466.7 g/sec) for SO_2 were calculated from coal which produced 1.2 lbs/million BTU's of SO_2. This value (1.2 lbs/million BTU's) was lowered to .8589 lbs/million BTU's which enabled the Wises Plant to meet air quality standards. The new emission rates were calculated from a ratio of .8589/1.2 = 0.71575.

The stack parameters for Ghent Units 3 and 4 at 95 percent, 75 percent and 50 percent are shown in Table 3.6-4. Results of predictive air modeling are presented in Section 5.2.2.1.

Table 3.6-4

Operating Parameters
Units 3 and 4

Parameter	Load Factor		
	95%	75%	50%
Emission rate of SO_2 (g/sec)	1365.1	1075.0	727.0
Emission rate of particulates (g/sec)	114.0	90.0	60.0
Stack Temperature (K)	410.8	399.7	388.7
Exit Velocity (m/sec)	23.2	18.3	12.8

3.7 TRANSMISSION LINE

3.7.1 Proposed Corridor

The proposed route of the 345 kV single circuit transmission line runs adjacent and parallel to the existing Ghent-West Lexington 345 kV line in a 100 ft corridor for 5.2 miles south to point "A", then in a southerly direction in a 150 ft corridor for a distance of approximately 35.2 miles to the proposed substation about 5 miles west of Frankfort in rural Franklin County (see Figures 1.3-3, 3.7-1). This substation and line is intended to strengthen the transmission network in this area. Since no rights-of-way have been acquired for the proposed primary route, changes and variations may become necessary as negotiations for easements progress.

3.7.1.1 Towers

The 345 kV transmission line will be supported by single circuit tangent lattice structures (Figure 3.7-2). The self supporting lattice type steel towers will have a span between 800 and 1200 ft, requiring approximately 6 towers per mile of right-of-way. The conductor will be a twin-conductor bundle per phase of size 954 MCM (45 x 7) ACSR, with a normal load capacity of 1194 MVA. The transmission line design and all electrical clearances will meet or exceed the requirements of the National Electric Safety Code.

3.7.1.2 Termination of Transmission Line

The 345 kV line will terminate at a substation about 5 miles west of Frankfort, Kentucky (see Figure 1.3-3). This substation will be needed to accommodate the growth of Frankfort with construction beginning in 1981. Additional transformers will be used in this substation in order to tie in the 345 kV line from Ghent to a 138 kV line which will run from Frankfort to Shelbyville, Kentucky.

3.7.2 Construction Methods

The following sections describe the techniques for constructing the proposed 345 kV transmission line from the Ghent Steam Electric Generating Station Unit 4. The methods employed in construction of this line will vary according to the

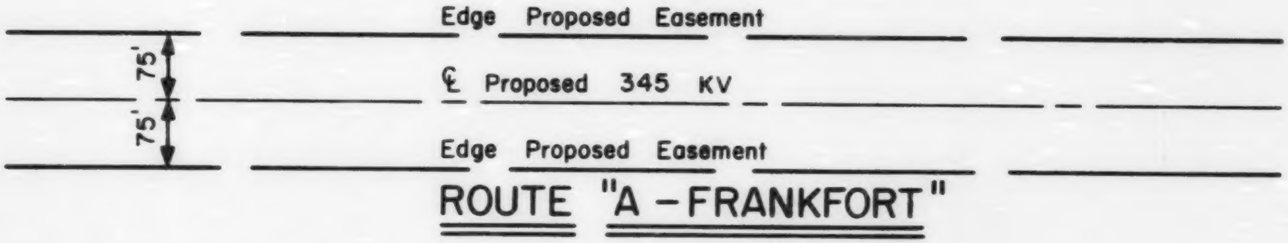


Figure 3.7-1. 150 ft proposed corridor of the "A-Frankfort" route.

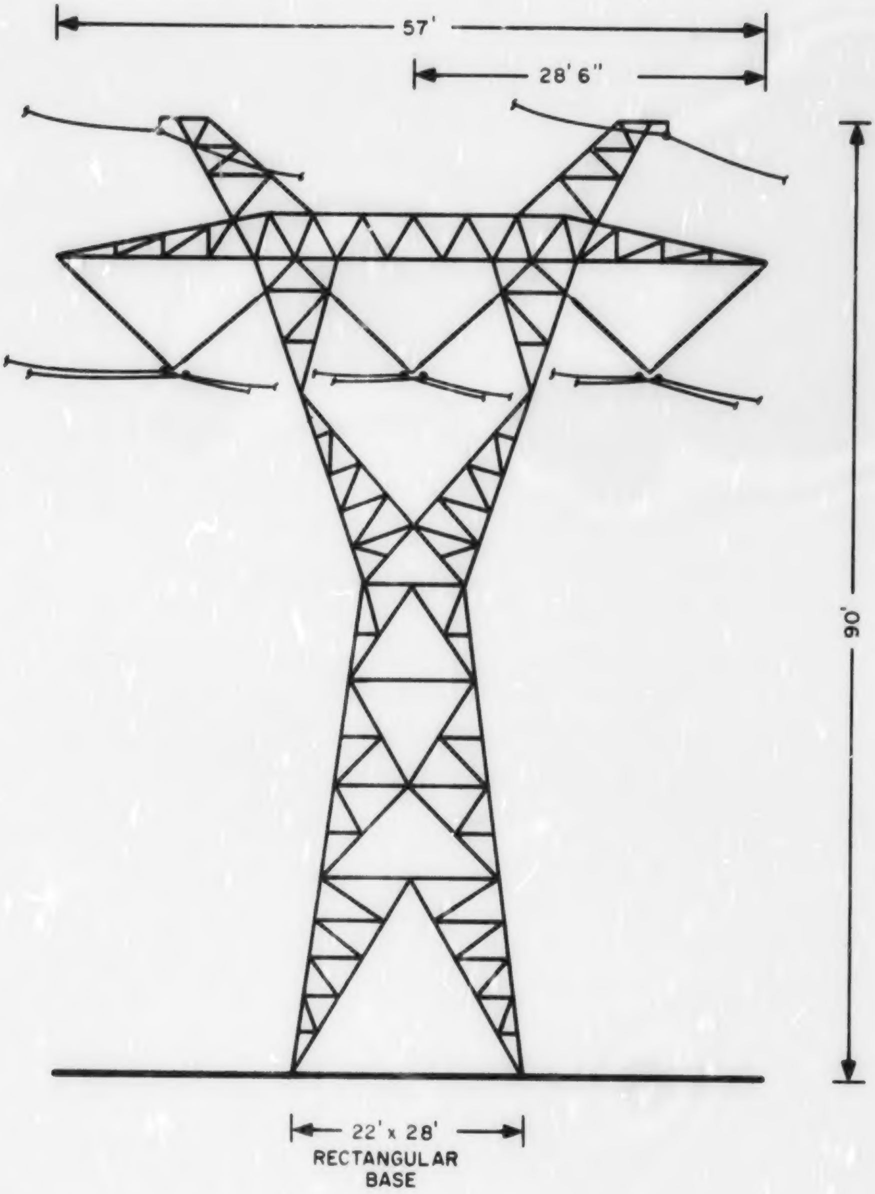


Figure 3.7-2. 345 kV single circuit self supporting tower.

specific site and route, time of year, weather and right-of-way or easement conditions. Estimated time involved with the proposed transmission line will total three years, of which actual construction will be one year.

3.7.2.1 Material Unloading and Storage Yards

Material unloading and storage yards will be located in the vicinity of the line right-of-way at intervals of approximately 15 miles, preferably at railroad junctions. Materials used in line construction will consist of tower steel, reels of conductor, insulators and conductor hardware. These material unloading and storage yards will determine delivery methods, material handling facilities, and weather protection requirements.

3.7.2.2 Field Offices and Equipment

Requirements for construction field offices will be minimal and will be located at the material unloading and storage yards. Construction field offices consist of a mobile office trailer, storage trailers and light utility vehicles. These locations will serve as places to headquarter construction equipment and as assembly points for workmen.

Construction equipment will consist of standard transmission line equipment with light to medium weight equipment mounted on rubber tires and heavier equipment such as bulldozers, heavy cranes, etc. mounted on tracks.

3.7.2.3 Access Roads

The proposed corridor is traversed by many federal, state and county roads providing good access to the route for construction equipment which will reduce to a minimum the amount of bulldozer work required for additional access or construction roads (see Figure 2.3-4).

3.7.2.4 Right-of-Way Clearing

3.7.2.4.1 Initial Clearing

The policy of Kentucky Utilities is to secure complete tree rights for transmission rights-or-way on private property because vegetation removal (e.g., trees) is necessary to permit line construction and to provide safe and adequate electrical clearance to the energized lines. These rights-of-way may be bought but are often occupied under easement. Therefore, any type of work done is subject to conditions contained in the easement and most often designates the type of initial clearing and manner of wood disposal.

Depending on the type of terrain and land use encountered during initial clearing, it may be possible to employ three major methods of clearing: clear cutting, selective clearing, and tailored clear cutting.

Clear cutting will be used only where conductor or structure heights are minimal and the removal of all trees is necessary to permit construction or safe operation of the energized line (Figure 3.7-3). However, this method may be specified by individual property owners or may be a condition of easement.

In areas where the aesthetic treatment of rights-of-way are of primary importance, the method of selective clearing will be used (Figures 3.7-4). This involves clear cutting to within 100 ft of the road and stream crossings, access and construction roads, tower sites and brush disposal areas.

Tailored clear cutting results in a corridor with undulating boundaries (Figure 3.7-5) and is used in hilly terrain where there is sufficient ground clearance to allow growth of mature trees on portions of the right-of-way.

Where the proposed route traverses an agricultural region advance arrangements. will be made with the property owners for any rescheduling of cultivation. Should the area already be under production, Kentucky Utilities will assess any crop damage or loss and compensate the property owner according to the crop's harvest price.

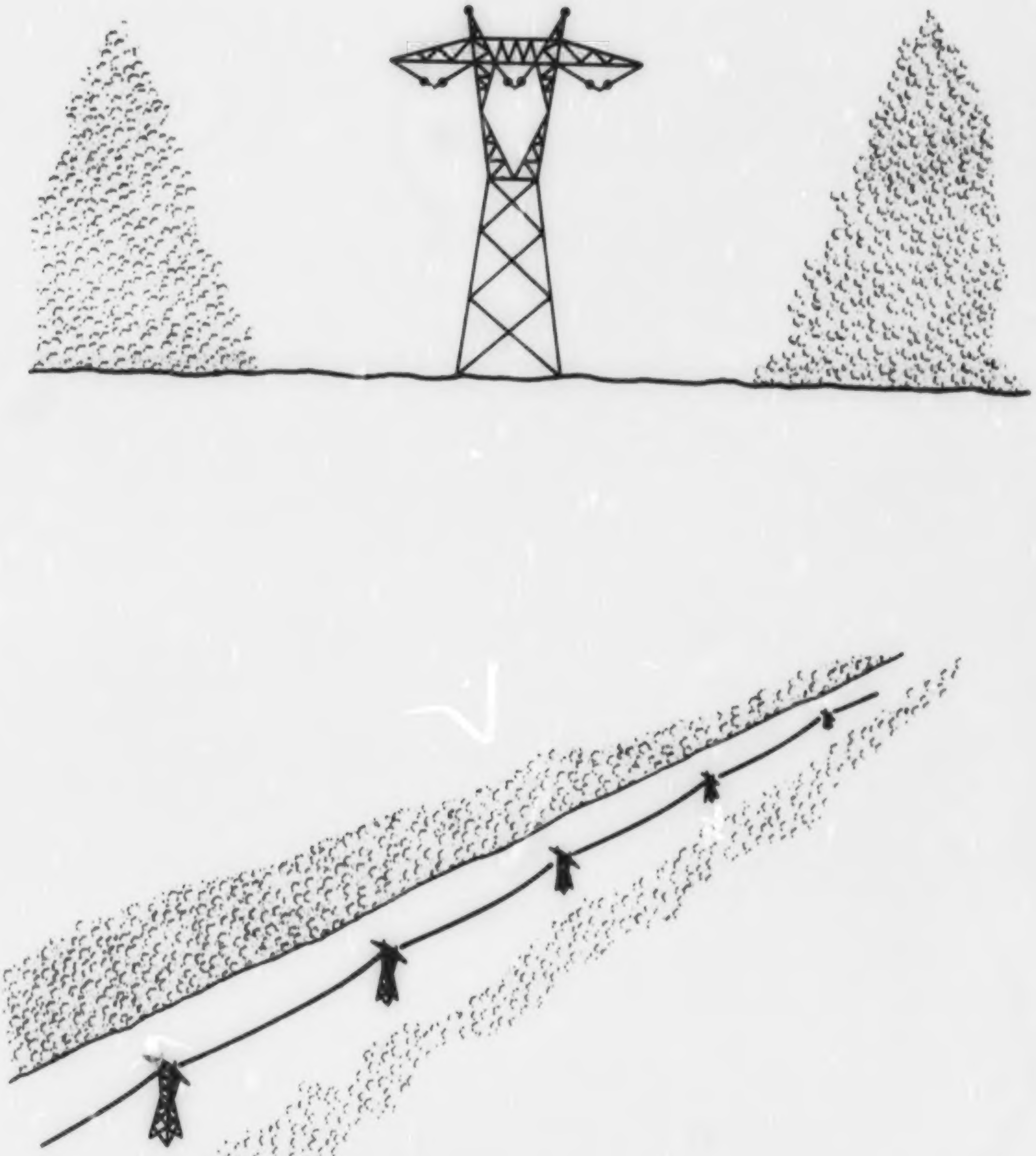


Figure 3.7-3. Plan of clear cutting technique.

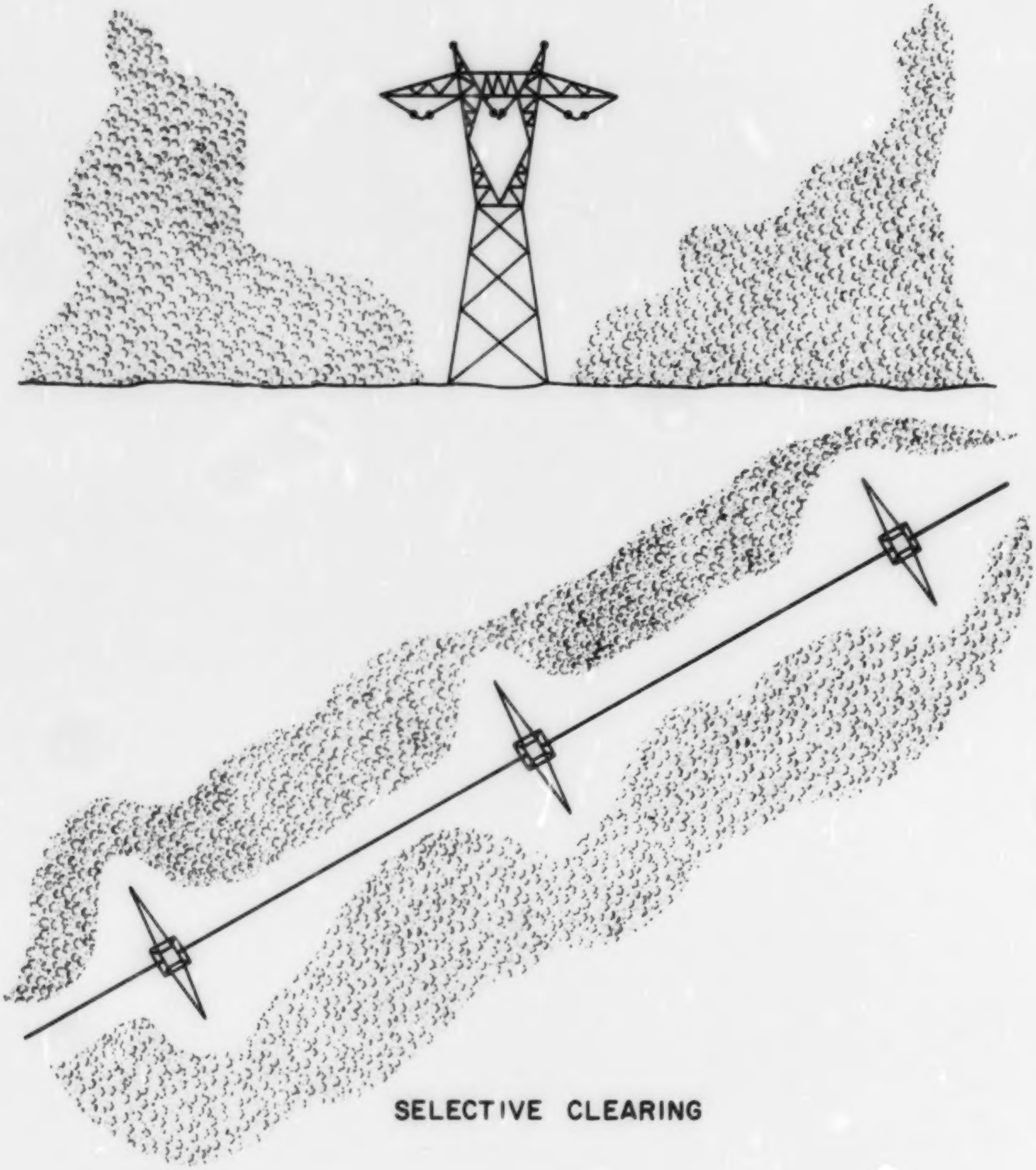


Figure 3.7-4. Plan of selective clear cutting technique.

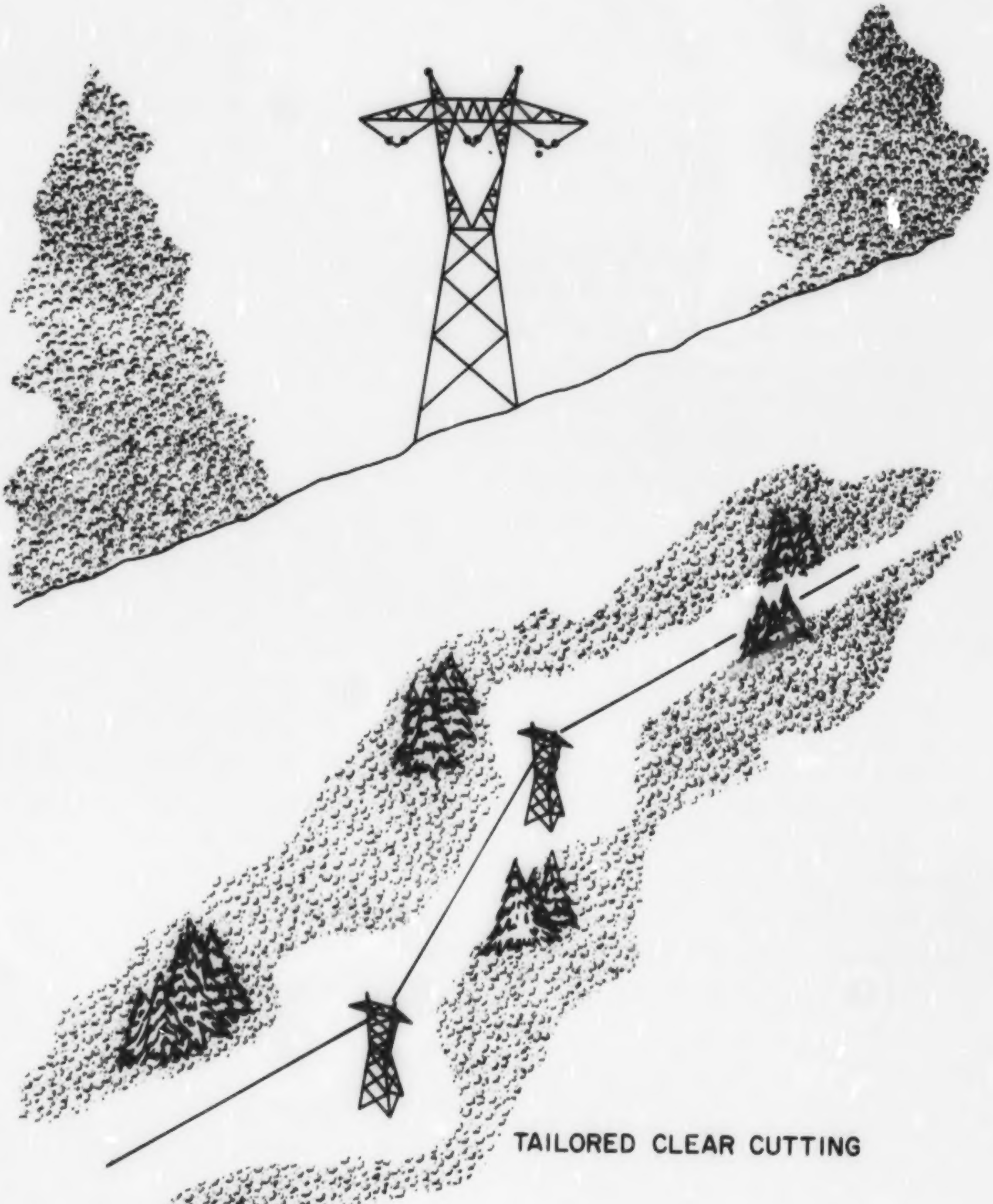


Figure 3.7-5. Plan of tailored clear cutting technique.

3.7.2.4.2 Stormproofing and Screening

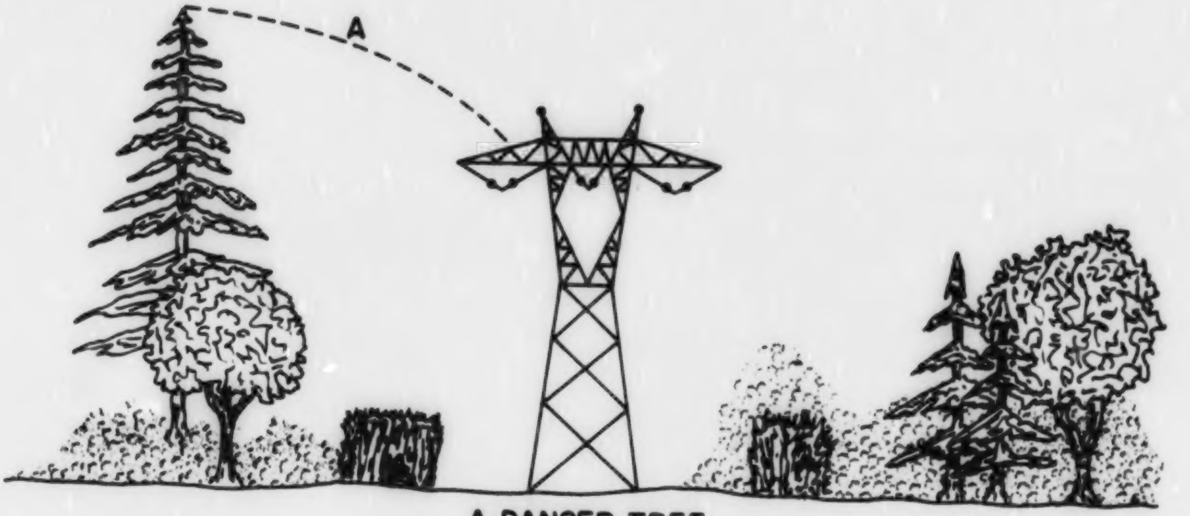
Any trees adjacent to the right-of-way that constitute danger of damage (e.g., falling) to the conductor or towers will be selectively removed upon the property owner's approval (Figure 3.7-6).

Screening of vegetation may be established when practical (and possible) at all paved road crossings where the right-of-way passes through wooded areas or heavily wooded fence rows. In areas where native vegetation provides a suitable screen, all tall growth-form species will be selectively removed while taking the necessary precautions to minimize damage to the low growth-form individuals (Figure 3.7-7). At locations where the low growth-form native trees and shrubs are inadequate for screening, taller species may be left in selected strategic locations or supplementary plantings of additional desirable low growth-form vegetation may be used (Figure 3.7-8). Similar screening techniques may also be employed where practical at stream, creek and wetlands crossings where there are aesthetically sensitive areas.

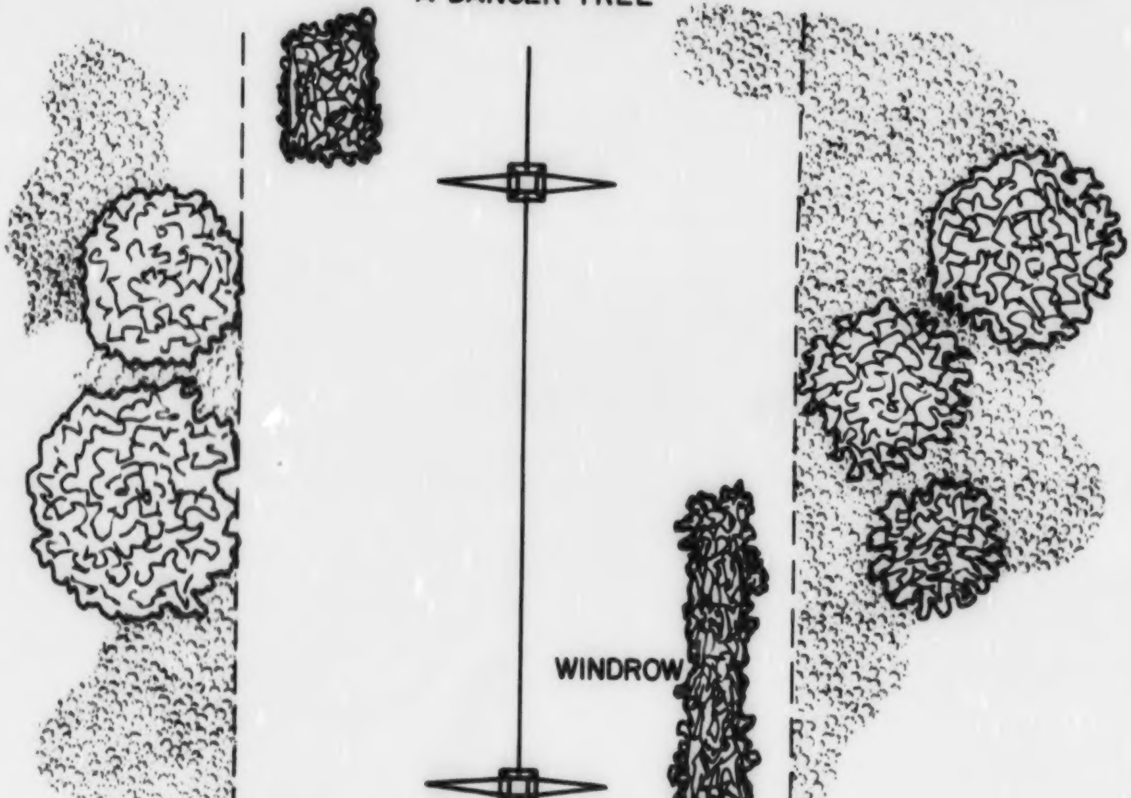
3.7.2.4.3 Wood Disposal

The disposal method of cleared wood will be dependent upon the volume and the type of material (whether it is of commercial value or wood waste). Wood of commercial value will be cut according to length determined by the property owner and stored out of the right-of-way areas with access available to the landowner. Normal disposal of wood waste may be by windrowing and burning. The topography, disposal site, waste volume, easement specifications and applicable legal controls will be considered in determining the appropriate disposal method.

Disposal of wood waste in the corridor will be done by windrowing along either or both sides of the right-of-way, 25 ft from the edge. This can serve as a source of wildlife cover and also assist in erosion control (Figure 3.7-6). The other method, burning, will be utilized at road or stream crossings and will be performed in strict conformity with state and local regulations.



A-DANGER TREE



DISPOSAL OF WOOD ON RIGHT-OF-WAY

Figure 3.7-6. Danger tree and disposal method of wood on right-of-way.

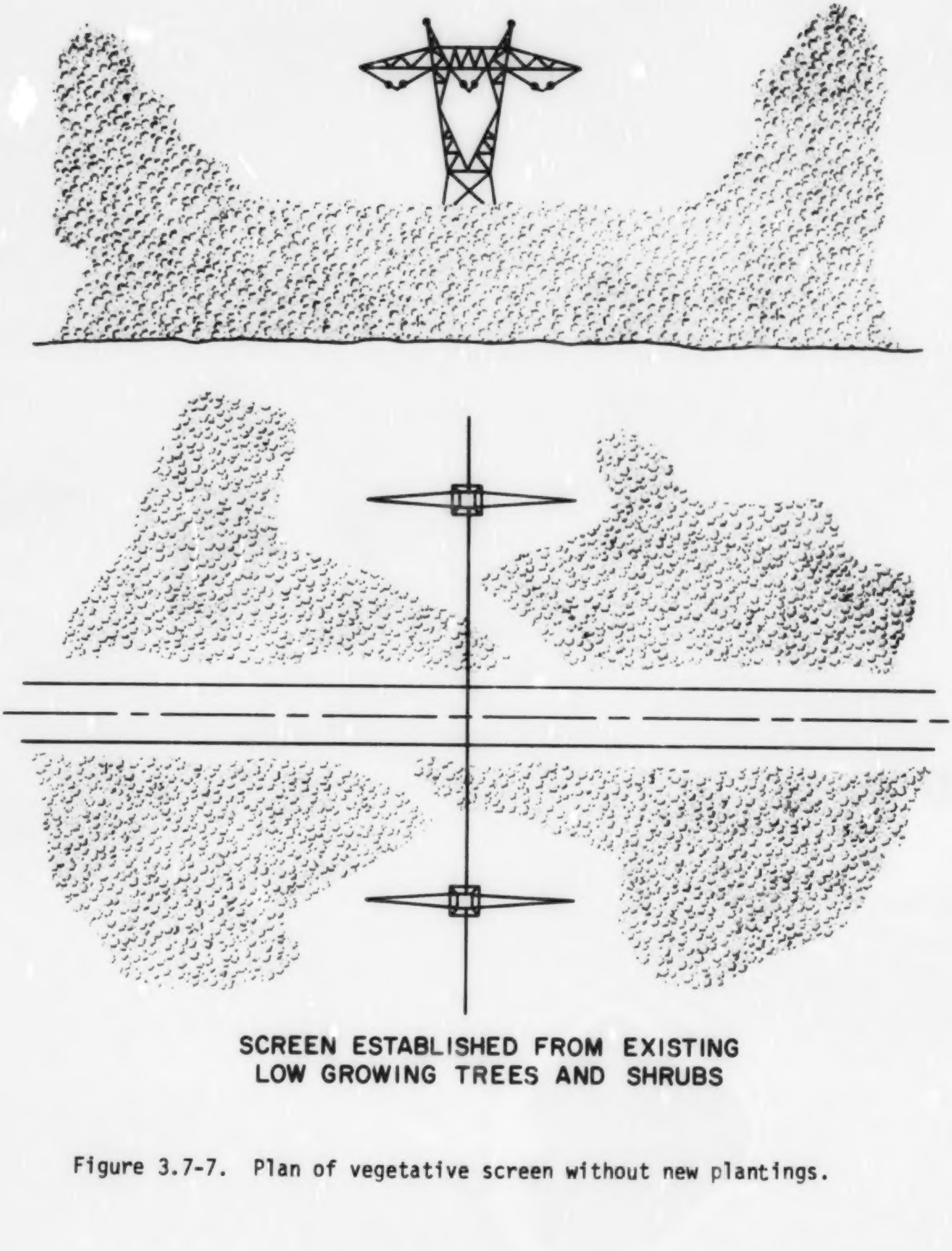
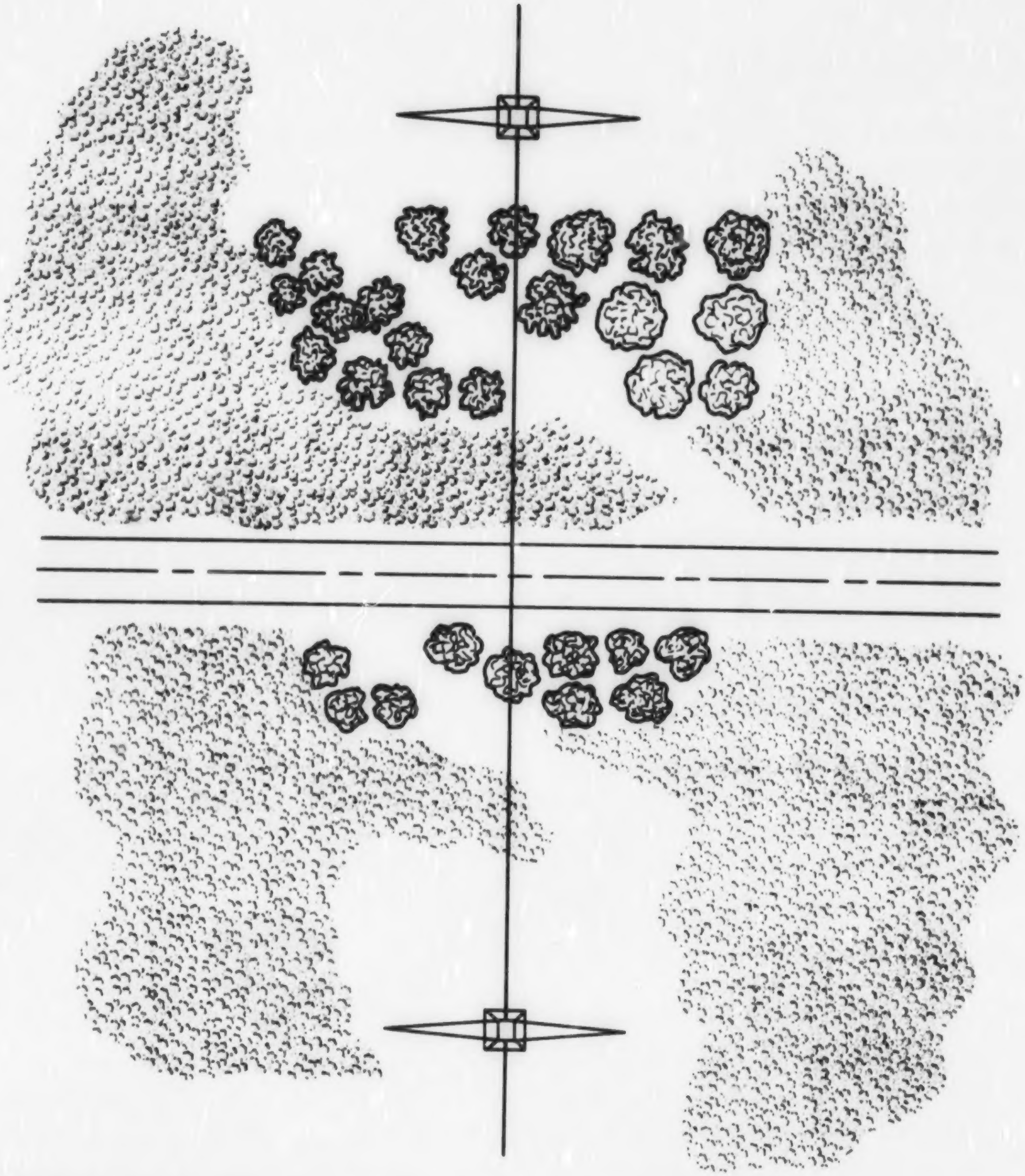

SCREEN ESTABLISHED FROM EXISTING
LOW GROWING TREES AND SHRUBS

Figure 3.7-7. Plan of vegetative screen without new plantings.



SCREEN DEVELOPED BY COMBINATION OF PLANTING AND NATIVE TREES

Figure 3.7-8. Plan of vegetative screen with new plantings.

3.7.2.4.4 Herbicide Use

Herbicides will not be used in the construction period for the purpose of initial right-of-way vegetation clearing. Limited use of herbicides may be used later for stump spraying to prevent sprouting. All herbicides used on the right-of-way will be applied according to manufacturer's label instructions.

3.7.2.5 Tower Erection and Wire Stringing

Tower assembly and erection involves the following steps: construction of the tower foundations using steel earth grillage, assembly of portions of each tower into subassemblies on the ground, and erection of these subassemblies into a completed tower unit using mobile cranes.

Installation of the conductors will be performed using the tension stringing method, which requires tension pull sites with temporary anchors, covering approximately 40,000 ft along the right-of-way. Use of this method will help minimize corona formation by abrasions on the conductor.

3.7.2.6 Erosion Control

To maintain erosion control, selective cutting of only line obstructions will be performed near bodies of water. Also where possible, towers will be set back away from river banks. In this way, natural vegetative cover will be preserved in those areas.

With the completion of line construction, final clean-up of the right-of-way will involve the removal of all equipment, cribbing, packing, scrap, temporary installations and other material plus restoration of the soil. Complete restoration of agricultural areas will be necessary due to the loss of the root material by bulldozing, while pasturelands will require only reseeding because the method of sheer dozing leaves the root. Temporary access and construction roads, and other disturbed areas (e.g., tower sites, etc.) will be back-bladed, disked, fertilized and seeded to reduce erosion and sedimentation.

3.7.2.7 Maintenance

Normal line inspection will be performed four times year (once every quarter) by helicopter to determine insulator and conductor damage from lightning and vandals; as well as clearance problems with trees on or adjacent to the right-of-way. The life expectancy of this facility is in excess of 50 years.

Approved herbicides will be used to maintain the right-of-way and will be applied by the selective ground leasal spraying method. These herbicides will be applied during periods in which the wind speed is less than 5 mph. Herbicide use is expected to be needed only once every five years and will be applied no closer than 50 ft from any streams. Aesthetic areas may also be maintained by employing light farm vehicles and hand cutting equipment. Required painting of the tower units would be done every 20-25 years.

Emergency maintenance, which will be required for sections of line downed during storms or other natural phenomena, will be performed as required. Should significant environmental disruption occur at the time maintenance is performed, Kentucky Utilities will consult with Soil Conservation Service, Forest Service, appropriate state agencies and private landowners to insure that any damage is properly corrected.

3.8 REFERENCES

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SECTION 4.0
ALTERNATIVES

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4.1 ALTERNATIVES NOT REQUIRING CREATION OF NEW GENERATING CAPACITY

The alternatives presented in this section are those which do not necessitate the construction of new generating units. The possibilities include: upgrading existing units or reactivating retired ones, base loading of existing peaking units, load curtailment, outside energy purchases, and energy conservation. In each case the feasibility and practicability of each alternative is discussed.

4.1.1 Upgrade Existing Units or Reactivate Retired Ones

As discussed in Section 1.2, Kentucky Utilities is anticipating a 500 MW demand over present generating capacity in 1982, and by 1984, a 1000 MW demand over present generating capacity during peak demand periods. Because of Kentucky Utilities' present capacity (1742 MW), it is not feasible or nearly impossible to upgrade existing units or reactivate retired ones to make up the expected 1000 MW increase peak load demand.

Kentucky Utilities present capacity is largely the result of construction which occurred during the 10-year period after World War II. The first units built during this period were at the Tyrone Station. The nameplate rating for these units were 25 MW for Units 1 and 2 and 60 MW for Unit 3. These three units are still in use today as peaking units and demonstrate that Kentucky Utilities is still utilizing its older units to help fulfill peak load demands.

Kentucky Utilities presently has no existing retired units. Units that have in the past been retired were completely dismantled and taken out of use.

At the present time, existing Kentucky Utilities generating units are utilized to their full safe operable ratings. Any upgrading of these units would entail practically new construction of generation units in place of the old. By building new capacity at Ghent, the existing capacity of the older units is retained.

4.1.2 Base Loading of Existing Peaking Units

Kentucky Utilities presently has a peaking capacity from seven generating units with an output of 193.4 MW. Three of these units at the Haefling Station are gas turbine powered and too costly to run as base loading units. The other oil and coal-fired peaking units which could conceivably be used as base load units, however, would also be much more costly to run compared to larger, more efficient base load coal-fired units (see Section 1.1). Even if the peaking units were base-loaded, the 193.4 MW total capacity of these units would not fulfill the increased load requirements expected by 1982.

4.1.3 Preplanned Load Curtailment

Preplanned load curtailment is a process by which a utility can request one or more heavy-use customers to cut back their electrical consumption at times of peak load. By utilization of this process, it is sometimes possible to reduce or delay plans for construction of new capacity by reducing peak load demand.

Kentucky Utilities does not have any contractual, interruptible loads. However, they can request their two largest industrial customers, Green River Steel and West Virginia Paper and Pulp (West Vaco) to curtail their operations or suffer a rate penalty for the next 6 to 12 months.

The terms of the Green River Steel contract specify that Kentucky Utilities may request them to cut back from their usual demand of 20-25 MW to a 5 MW load. If they do not cut back to 5 MW, then they pay a higher demand rate for the next 12 months.

The West Vaco contract is very similar except that the interruptible load is anything above 10 MVA (9 MW equivalent). Their load normally runs as high as 25 MVA (23 MW equivalent). They receive a 6-month penalty for non-compliance.

The process of requested load curtailment does not greatly affect summer peak load projections and future planning of needed capacity. Historically, this curtailment has represented a depression in load demand of 15-20 MW and has already been included in future planning.

4.1.4 Energy Purchase

As explained in subsection 1.2.5, Kentucky Utilities is a member of the Kentucky-Indiana Pool (KIP). The KIP members plan their generating capacity on a joint basis and thus take advantage of any purchase or sales which would minimize the creation of new generation capacity.

Normally, deficits occur before the addition of new generating capacity and surpluses result after new capacity is added in any given system. This fluctuation is minimized through energy purchases before construction and outside energy sales after construction. Through these purchases and sales, a utility company is ultimately responsible for its own load demand. Energy purchases in lieu of unit construction are not possible unless neighboring companies have over-built and have a large excess of capacity over a long period of time. This is not the case with Kentucky Utilities since there is not enough excess capacity obtainable from its neighboring companies to fulfill their projected load demand.

4.1.5 Advertisement and Energy Conservation

Kentucky Utilities' present advertising program consists principally of a monthly bulletin enclosed with billings (The Kentucky Utilities News) and bimonthly newspaper articles in the main newspapers of the service area. Short television spots are also utilized, but are infrequent. The direction in which the present advertising has evolved is toward customer education in energy conservation. Typical themes involve home insulation tips for existing and new construction, efficient use of electrical appliances and efficiency in air conditioning operation. All of the Company's advertising stresses the importance of wise use of electricity.

These advertising measures have not tended to decrease the rise in per capita consumption significantly. As shown in Section 1.2, the rise in consumption is primarily due to a larger reliance on electricity for home heating and air conditioning in new construction and cannot realistically be overcome by Kentucky Utilities' conservation measures. However, Kentucky Utilities does offer special rates for home water heating units which are designed to operate during off-peak periods.

Peak demand pricing, as a method to reduce energy consumption during periods of peak electrical usage, is not utilized by Kentucky Utilities. This is principally due to questions concerning economic factors and the amount of energy savings to be realized if this program were to be instituted in Kentucky.

4.2 ALTERNATIVES REQUIRING CREATION OF NEW GENERATING CAPACITY

This section includes a discussion of alternatives requiring creation of new capacity. Included in this section are: a listing of energy sources, the comparison of an alternate site and plant design alternatives.

4.2.1 Selection of Energy Sources

Energy sources that were considered to be viable alternatives to the selected coal-fired steam electric generating units were nuclear fusion and perhaps to a lesser degree hydroelectric and oil or gas fired steam electric generating units. Geothermally produced electricity was not considered because of the absence of any large geothermal steam sources in the service area. Solar energy, wind energy and nuclear fission were not considered technically feasible for large scale electric generation by the early 1980's and therefore were not considered.

4.2.1.1 Nuclear Fission

There are several important factors that must be considered in the selection of nuclear power as an energy source. These factors have been weighed by Kentucky Utilities in their rejection of nuclear power as an energy source at this time. The factors that will be discussed are economic, the lead time factor, unit reliability and system compatibility.

Economic element--While the initial construction cost for nuclear plants are somewhat higher than fossil fuel plants, nuclear power can be a more economical source of base load generation, depending on unit sizes, system load patterns, and fuel availability. This is brought about by somewhat lower fuel cost which in time should offset the higher initial construction cost. In order to achieve this saving, however, unit sizes larger than KU Company feels are justified on its system during the early 1980's must be installed.

Lead time--The lead time for completion of a nuclear plant is much longer than that required for a fossil fuel plant. It takes approximately 8-10 years for a nuclear plant to go from its planning stage to completion, compared to 4-6 years for a fossil fuel fired plant. In Kentucky Utilities' case, a delay of 2-6 years in adding additional capacity will cause problems in fulfilling system demands, requiring outside purchases in the neighborhood of 500 MW in 1981, and in increasing amounts in each year thereafter for the period of the delay (Figure 1.2-4).

Unit reliability--The minimum size of a nuclear unit that would be economically worthwhile for Kentucky Utilities to construct would be in the range of 1000 MW and above. Construction of this size unit would in time overcome the larger initial construction cost through lower fuel costs. However, by constructing a 1000 MW nuclear unit, unit reliability would be a problem compared to original plans for two 500 MW coal-fired units. Without purchasing additional capacity, Kentucky Utilities would not have adequate reserves to cover the loss of this unit due to breakdown, maintenance or refueling (Figure 1.2-21).

4.2.1.2 Hydroelectric

Kentucky Utilities presently owns two hydroelectric stations, at Dix Dam and Lock 7. Dix Dam has three 8 MW units for a total of 24 MW and Lock 7 has three 0.7 MW units totaling 2.1 MW. The capacity of hydroelectric generating units in Kentucky is usually small and the output dependent upon available water flow. There is no impoundment of water in Kentucky large enough to supply the volume of flow necessary to provide Kentucky Utilities with dependable power which is adequate in capacity to fulfill energy requirements predicted for 1981.

4.2.1.3 Oil and Gas Fired Steam Electric Generation

Although oil and natural gas are excellent fuels for steam electric power generation, their availability and cost restrict their use for base load unit operation. Fuel oil is presently being used in the two peaking units at Tyrone. However, for continued operation, the fuel cost is restrictive. In addition, the availability of fuel oil for the future is uncertain and the Federal Energy Administration (FEA) has curtailed the use of natural gas for the production of electricity.

4.2.1.4 Coal-Fired Steam Electric Generation

Coal, as a fuel for steam electric generation, is the best alternative as an energy source for Kentucky Utilities. The availability of coal from east Kentucky on a long-term basis, coupled with the higher efficiency of newer generating unit components and the shorter lead time (4-5 years) to put the unit on-line, make the coal-fired units a desirable alternative.

The two proposed coal-fired units would be comparable with the two existing units at the Ghent Station. For this reason, some minimization of adverse environmental impact and cost will be derived through joint use of existing coal unloading facilities, control mechanisms and operational personnel.

There are two alternative types of coal to be considered in new generating unit operation. The two types are high sulfur and low sulfur coal. Because of the state and federal New Source Emission Standards, the use of high sulfur coal would require an air pollution scrubber device to remove sulfur from the emissions. The use of low sulfur coal requires no sulfur removal to meet the state and federal emission standards. Factors associated with a sulfur dioxide scrubber device are: (1) construction and operation, (2) costs, (3) possible technical problems, and (4) the necessity of land area required for disposal of SO_2 sludge. It is therefore possible that a utility could pay more for low sulfur than for high sulfur coal and still break even on a cost/KWH basis. At present day prices for low and high sulfur coal, the alternative of using low sulfur coal is more favorable for the Ghent Station.

4.2.2 Comparison of Alternative Sites

The capacity of a facility required to satisfy the future service area demand of approximately 1000 MW by 1983 suggests that construction of two generating units at an existing station is both feasible and desirable. The need for duplication of certain systems such as coal unloading systems and the need for more transmission lines and substations is minimized. Therefore, the economic and environmental impacts due to facility construction is lessened.

This consideration led to the choice of the Ghent Station as the preferred construction site, with the second most feasible alternative the Green River Station in Muhlenberg County, Kentucky. The following discussion describes this station in general terms as a second alternative and gives the rationale for choosing Ghent as the primary candidate site for construction.

4.2.2.1 Water Availability

Water is readily available at both the Ghent and Green River Stations, with each being situated directly on river banks. The Green River, however, has a mean flow of 9146 cfs compared to a mean Ohio River flow of 130,500 cfs at the Ghent Station. River flows at Green River are known to decrease to 600 cfs compared to 10,500 cfs on the Ohio River (U.S.G.S. 1975). Especially during times of low flow, it can be seen that the Ghent Station would be a more desirable site, since make-up water and service water demand would comprise a smaller percentage of the total river flow and, therefore, probably cause less adverse environmental impact. Also, since the Ohio River maintains a higher flow, it will be better able to assimilate the impact of the additional barge traffic which will be utilized in the transport of coal to the plant.

4.2.2.2 Road, Rail and Barge Access

Road, rail and barge access is readily available to the Green River as well as to the Ghent Station. The Green River is located approximately 8 miles from the Western Kentucky Parkway, giving convenient access to Louisville and other major cities of Kentucky. In addition, rail connections exist via the Louisville and Nashville Line directly to the plant. Coal is transported from the coal mines nearby via the Green River to the plant by way of barge. Other shipments to the plant can utilize the connecting Ohio River barge network, which is located 82.3 river miles downriver of the Green River Plant. Transportation facilities for the Ghent Station have been described in Sections 2 and 3.

4.2.2.3 Cost Estimates

Economic factors that are taken into account in the 1981 and 1983 unit location are construction costs of generation units and transmission facilities, annual fixed charges for generation and transmission, and fuel costs for each unit location. Table 4.2-1 illustrates these costs for each of the proposed units if both were placed at either Ghent or Green River. As can be seen, locating the two additional units at the Ghent Station would result in substantial savings both in initial construction costs and annual operational costs over locating the units at the Green River Station.

The difference in costs between the locations of the two stations arises principally from three factors. One is the necessity of installing sulfur dioxide scrubbers at the Green River Station since it is a mine-mouth plant and would use high sulfur coal. The cost of installation and operation of SO_2 scrubbers is substantial. The second factor involves the additional amount of land that would need to be purchased for construction of new structures at the Green River Station. It is estimated that an additional 500 acres are needed. The last factor is the addition of transmission lines and facilities that would be needed at the Green River Station as well as the added cost of operation and service of these lines.

4.2.2.4 Ecology

Less topographic variation and therefore less variety in plant communities exist at the Green River Plant than at Ghent. Two alluvial terraces lie in stepwise fashion, one above the other, at the Green River Station. The lower terrace floods frequently and its vegetation is dominated by American elm, American sycamore, sweetgum, yellow poplar and hackberry. The power plant is located on the second terrace, which is relatively free from flooding, and whose vegetation is a mixture of that found on the lower terrace and the slopes above. Hillside woodlands are dominated by sugar maple, sweetgum, shagbark hickory, black oak, yellow poplar, and in ravines and near drainageways, American beech. Shining sumac, devil's walkingstick and greenbrier are abundant in disturbed areas in openings and at woodland edges. Broomsedge bluestem, little bluestem and purpletop are common perennial grasses in openings.

Table 4.2-1.

Alternative Site Cost Comparison
Two Additional Units*
1 November 1976 Price Level

Year	Location	Construction Cost		Annual Cost			
				Fixed Charges			
		Generation	Transmission	Gen. (15.5%)	Trans. (16.5%)	Fuel Cost	Total Cost
1981	Ghent #3	$242,000,000	$ 499,000	$37,510,000	$ 82,335	$41,887,943	$ 79,480,278
	Gr. River #5	297,000,000	20,576,000	46,035,000	3,395,000	56,681,395	106,111,395
1983	Ghent #4	234,000,000	20,916,000	36,270,000	3,451,000	47,065,297	86,786,297
	Gr. River #6	265,479,000	18,809,000	41,149,245	3,103,485	63,687,222	107,939,952

* The proposed units were assumed to operate at a 70% load factor and to produce 3,066,000 MWH per year.

Diversity of vertebrate fauna at the Green River Station is probably not as great as that of the Ghent Station site because of the greater topographic and physiognomic variety characterizing the latter. The location of the Green River site in the Western Coal Fields region promotes faunal assemblages more characteristic of southern forests than do habitats at Ghent. The Green River is smaller and of less significance as a migratory pathway of waterfowl than is the Ohio River, although mammals associated with its margins are similar to those at the Ghent site. Animals found near the Green River plant site proper are characteristic woodland forms. However, across the river from the plant site and occupying considerable areas both upstream and downstream are alluvial floodplains in pastureland and/or farmland which support farmland and prairie species.

Game and other hunted animals likely to be found at Green River include cottontailed rabbits, gray and fox squirrels, white-tailed deer, bobwhite, mourning doves, opossums, raccoons, gray and red foxes, and waterfowl. Neither woodland habitats, edges nor openings (fields, pastures) appear to have the quality for wildlife habitat as do comparable areas at Ghent (LGL Limited, U.S. 1976).

In order to construct two additional units at the 458 acre Green River Station, nearly all the land supporting new unit facilities (approximately 500 acres) would need to be purchased and cleared. The impacts of this action are much greater than would be experienced at the Ghent Station where most of the construction site has been previously cleared as a materials lay-down area for the construction of Units 1 and 2.

Qualitatively, the ecological effects of unit construction and operation on the aquatic life of the Green River would be similar to that on the Ohio River. However, due to the Green River's smaller flow and width, the quantitative ecological impact would be greater. An increase in plant discharges as well as increased barge traffic needed to supply coal to new units at Green River are examples of such impacts. Due to greater flow on the Ohio River, the overall impact would be less than that on the Green River.

4.2.2.5 Demography

Muhlenberg County, with a 1970 population of 27,537, is predominately a rural area. The largest town, situated approximately 3 miles southwest of the Green River Station, is Central City which had a 1970 population of 5450. The 1972 estimated per capita income for the county was $2795.

The Green River site and the Ghent site are favorable demographically for the additional units. Both have comparatively low populations and the increased employment that would be provided by a larger power station would be welcomed.

The socio-economic impact from temporary construction crews at the Green River Station would be somewhat higher than at the Ghent Station due to the fact that construction crews have been present at the Ghent Station since beginning of construction of Units 1 and 2 (since 1970) whereas no large crews have been at the Green River Station since the construction of Unit 4 which ended in 1959.

4.2.2.6 Climate and Air Quality

The climate of the Green River area is of the humid, temperate type. The mean annual temperature is about 57F, varying from a mean of 37F in January to a mean of 76F in July. With these climatic conditions, the area has a growing season of approximately 180 days.

Precipitation in the Green River project area is fairly evenly distributed throughout the year, with smaller amounts occurring in late summer and fall. The average annual rainfall is approximately 42 inches (U. S. Corps of Engineers 1975).

The general climate of the area around the Green River Station is comparable to that at the Ghent Station site. The factors affecting stack emission dispersion, such as mixing height and stability factors, are comparable.

The Kentucky Department for Natural Resources and Environmental Protection (1975a) has given both the Ghent and Green River areas the same priority class for particulates and sulfur dioxides (priority Class I for particulates and priority Class II for sulfur dioxides). Table 4.2-2 illustrates the 1975 ambient air quality at Ghent and Central City (near the Green River Station) and the classification limits set by the state for the priority class designations (Kentucky Department for Natural Resources and Environmental Protection 1975b).

Table 4.2-2

1975 Ambient Air Quality

	Priority class (AQCR)	Annual mean µg/m³	24-hour maximum µg/m³
Central City			
Particulates	I		
Limits		> 95	> 325
1975 ambient		55	114
Sulfur oxides	II		
Limits		60-100	260-455
1975 ambient		9.0	47.8
Ghent			
Particulates	I		
Limits		> 95	> 325
1975 ambient		38	102
Sulfur oxides	II		
Limits		60-100	260-455
1975 ambient		21.1	116.9

4.2.2.7 Land Use

Physiographers (Fenneman 1938) place the Green River Station in the south central portion of the hilly uplands of the Western Coal Fields. The Western Coal Fields have an undulating hilly topography. Elevations range from 363-750 MSL, with an average elevation of 538 ft MSL. Broadly alluviated river floodplains at elevations ranging from 390-410 ft MSL are a marked physical feature.

The area surrounding the Green River site, like that of the Ghent facility, once supported mature hardwood forests. Although essentially no original stands of timber remain, the countryside is presently more forested than is the Ghent area, but only with second and third growth timber. The extensive floodplain of the Green River is largely farmed or in pastureland; however, a very narrow floodplain exists locally on the power plant site of the river, and most of the land is forested. Much of the land in Muhlenberg County to the south of the Green River plant has been surface-mined for coal. (The nearest extensively mined lands are several miles distant.)

4.3 SYSTEM ALTERNATIVES

4.3.1 Cooling System

The function of the cooling system is to remove waste heat that is produced from the condensing of steam after it passes through the turbine system. Alternative cooling systems that are applicable to the Ghent Station include (1) once-through cooling, (2) cooling lake, (3) wet mechanical draft towers, (4) dry towers, (5) wet natural draft towers, and (6) wet/dry towers and spray canals.

Once-through cooling at Ghent would involve pumping Ohio River water, utilizing it as cooling water, then discharging it back to the Ohio River. The advantages of once-through cooling systems are that they are normally the simplest and most economical to operate and also have the lowest consumptive use of water. The disadvantages are that there is usually limited availability of large supplies of cooling water and that the effluent may violate water quality standards.

As an alternative cooling system for Units 3 and 4 at the Ghent Station, once-through cooling does not seem to be a feasible alternative. There is a 67 ft rise from normal pool elevation of the Ohio River to the plant grade. The costs associated with pumping river water at a rate of approximately 1262 cfs to this height is not considered cost efficient as compared to the mechanical draft cooling tower system of the type used in Units 1 and 2. The cost of pumping for the once-through system could be lessened by the construction of caissons as a means to lower pumping height. The cost of this construction however would probably offset any gain realized from lower pumping costs. Another problem associated with once-through cooling systems is the present uncertainty of future environmental legislation concerning cooling systems. Once-through cooling systems, due to their processing of larger volumes of water, have higher impingement and entrainment rates, require more biocide treatment and discharge more heat. Due to these higher impacts and the uncertainty of compliance with both present and future legislation, another means of cooling is the more desirable alternative at this time.

Construction of a cooling lake involves containment of a large enough body of water to use as a closed cycle cooling reservoir. Spray ponds are a modification of this system which accelerates the cooling through installation of spray modules. A smaller body of cooling water is necessary for the latter system. Spray ponds or a cooling lake are also undesirable alternatives due to the lack of favorable topography associated with the Ghent Station for construction of these facilities. The costs associated with and the environmental impacts of constructing a large enough body of water necessary for the cooling of 1000 MW is restrictive in this case.

The various forms of cooling towers available can be divided initially into two basic categories: wet and dry. The wet towers are operated by forcing air through a fill pack through which the water to be cooled is also circulated. The air movement is induced either by natural draft or mechanically, by fans. The dry type cooling towers incorporate closed cycle water circulation through finned heat exchangers. The air movement is again induced either by natural draft or mechanical fans. A third type of cooling tower incorporates a wet-dry combination. The advantage of this system is the reduction in the amount of water loss encountered in a totally wet system.

The most common type of cooling tower used today is the induced-draft evaporative crossflow tower. This form of cooling is used as a base in Table 4.3-1 to compare the relative cost and power usage with the other types of cooling systems. At the present time it seems that the induced draft wet tower is the most economical alternative unless the size of the generating facility is large enough that the lower operating costs of natural draft towers will result in lower total costs with time (Kolflat 1974). The natural draft cooling towers, however, have the greatest potential for adverse aesthetic impact and obstruction due to their size and visibility. High level plumes are frequently associated with these towers.

Table 4.3-1

Comparative Cost And Power For Various Types Cooling Towers*

Tower Type	BHP Fan/Pump/Total	Cost Factor
WET		
Mechanical Draft Wood or PVC	7,600/8,200/15,800	BASE
Mechanical Draft Concrete	7,600/8,200/15,800	1.6
Natural Draft 2 Shell	-- /12,400/12,400	4
Natural Draft 1 Shell	-- /13,800/13,800	3
WET & DRY		
Parallel Path Wood or PVC	9,600/8,400/18,000 19,200/5,800/25,000	2--3
Parallel Path Concrete	9,600/8,400/18,000 19,200/5,800/25,000	3--5
DRY		
Mechanical 5 inch Hg A	64,000/8,000/72,000	10
Mechanical 12 inch Hg A	32,000/4,000/36,000	5

* All towers taken at same design wet and dry bulb temperatures. Same water flow, range and approach is taken for all towers except where necessary to use a more practical condition. Based on Marley pricing information published in 1970.

Source: Kolflat 1974.

The wet/dry induced draft towers, along with the completely dry towers, seem to be most effective in reducing evaporative water loss. However, this advantage is not considered significant to overcome the greater number of towers needed for this system.

The induced draft evaporative towers compare favorably with other alternative systems on the basis of tower height, land committed, construction effects and impacts on humans and biota. While frequent visible plumes can be expected from tower operation, little or no effect from the plumes is expected on transportation, agriculture or other activities.

4.3.2 Intake System Alternatives

The intake structure proposed for Units 3 and 4 consists of a submerged intake on the river bed equipped with a bar grill and traveling screens. The intake velocity is not expected to exceed 0.5 ft/sec. Other alternatives investigated were a screen pipe type intake structure and a Ranney well type intake structure.

The screen pipe intake system consists of a perforated pipe placed in the waterway such that passing current will sweep debris downstream (Figure 4.3-1). This system can be very effective in reducing fish mortality through very low approach velocities with a reasonable length of perforated pipe and also by its placement in a less productive zone of the river.

The multiport pipe intake was not proposed for Units 3 and 4 due to its relatively high construction and structural costs and because little operating experience is available. Those comparative engineering disadvantages which contribute to the high costs are as follows:

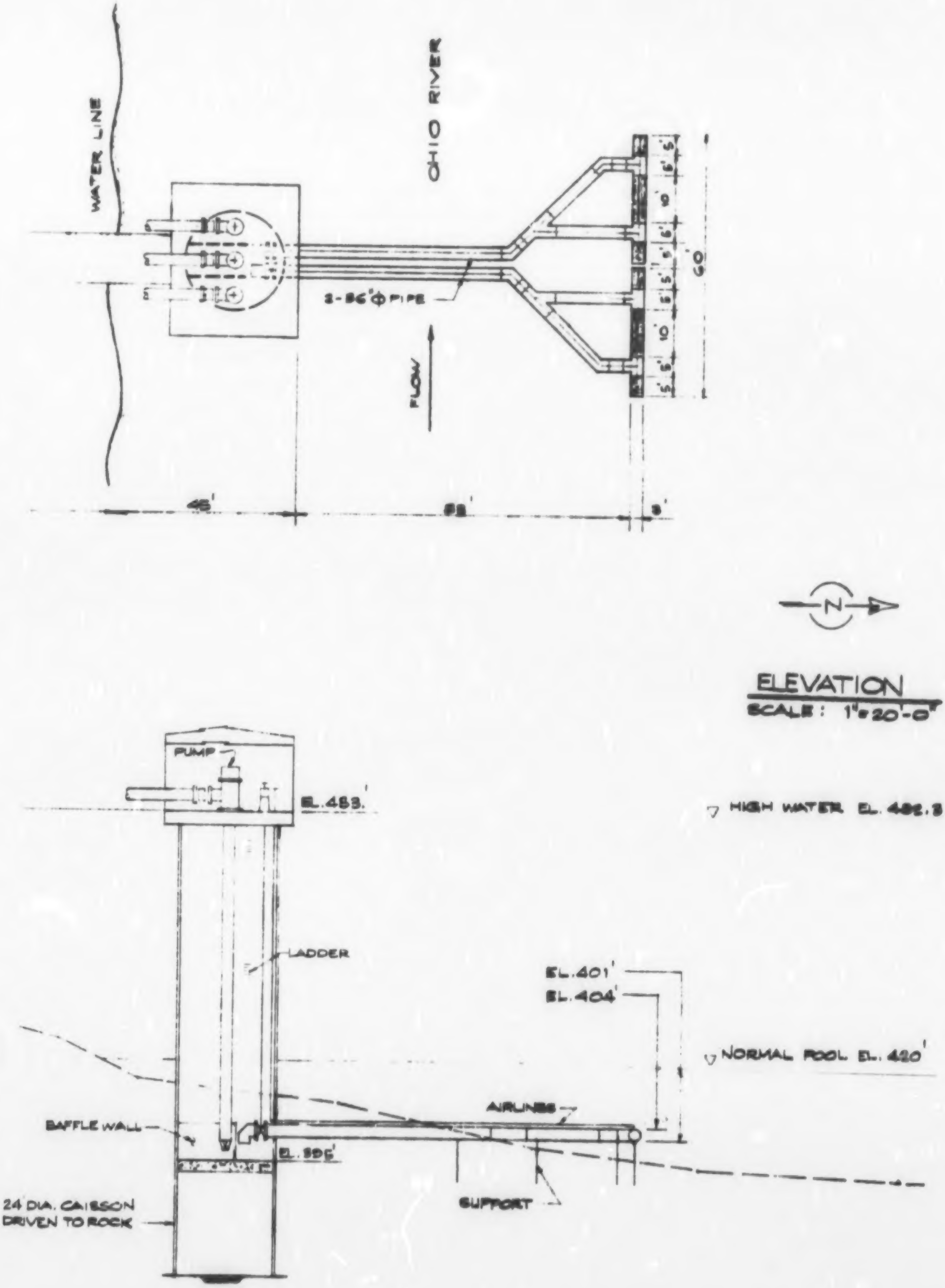

Figure 4.3-1. Conceptual multiport pipe intake structure.

1. The U.S. Army Corps of Engineers requires a clearance of 15 ft between the normal river pool level and the top of the submerged pipe so as not to be a navigational hazard. To meet this requirement, the pipe would have to be located at a depth of about 23 ft below normal pool elevation which would necessitate that the pipe extend about 250 ft from the shoreline. Protection of the supports of such a pipe against river scour and against the dynamic forces of the river current would be a special design consideration.

2. River debris and sediment are likely to block or clog the screen slots. For this reason, costly provisions would have to be made to backwash the screens periodically by air or water.

3. Frazil ice deposition on the pipe may clog the screen openings during severe winters. Sufficient field experience regarding the performance of such intakes with respect to frazil ice is not available.

4. The cost and repair time involved with accidental damage to this system from barge traffic is also a consideration.

The Ranney well type intake system consists of a cylindrical caisson approximately 16-18 ft in diameter with screen pipes projected into the aquifer below the river bed. Advantages are that periodic maintenance dredging would not be required and that, due to the filtration effect of the aquifer, relatively pure water would be provided for make-up. The disadvantage is that at least six Ranney wells would be required to supply water for Units 3 and 4 and these wells would have to be spaced at least 1500 ft apart, necessitating the acquisition of a much larger tract of land than the site currently requires. Additionally, the structural cost of the Ranney well type intake system is several times greater than that of the intake system proposed for Units 3 and 4.

Based on the preceding discussion, and in consideration of the favorable operating experience of the Unit 1 intake structure from both an engineering and environmental standpoint (see section 5.2.1.5), a very similar design was selected to be used for Units 3 and 4.

4.3.3 Discharge System

Two discharge arrangements for water utilized in plant operation have been chosen for Units 3 and 4. These involve discharging once-through service water directly to the Ohio River and discharging all other utilized water indirectly to the Ohio River via the existing ash pond. The latter case utilizes the ash pond as a treatment facility. The ash pond discharge structure and the service water discharge structure for Units 1 and 2 are now in operation. The existing ash pond discharge structure is adequate for Units 3 and 4. A similar service water discharge structure is proposed for Units 3 and 4, and no other alternative was considered.

4.3.4 Ash Disposal

A disposal method for both bottom ash and fly ash is necessary for the proposed units. It is planned that the bottom ash will be sluiced to the existing ash pond for disposal. Since this method poses no difficulty in meeting discharge standards and is the most economical, no other alternative was considered.

Due to the smaller sized particles and therefore slower settling rate involved with disposal of fly ash in ash ponds, several alternatives were first considered before deciding upon the method of disposal into the existing ash pond. Other alternative methods considered included the construction of a separate ash pond for disposal of fly ash with no discharge and the sale of the fly ash for use in the cement industry. Construction of a dry-type ash pond would result in the highest economic costs of the three methods and would present certain engineering problems not easily resolved (e.g., dry ash transport and elimination of fugitive dust). The selling of fly ash is by far the best method for disposal. Unfortunately at the present time there is no market in the region for fly ash. The proposed fly ash disposal method for Units 3 and 4 enables storage of dry fly ash in a silo before sluicing to the ash pond. This will allow for its removal and sale should a desirable market develop at some future date. Until then, disposal of fly ash into the existing ash pond is planned.

4.3.5 Fuel Delivery

Alternative delivery modes for the transportation of coal to the Ghent facility consist of barge, train, truck and slurry pipeline. The choice of mode depends upon the constantly changing nature of cost, fuel-efficiency and environmental considerations. Trucks carry the highest adverse impacts in terms of fuel costs, emission of pollutants and damage to roadways. Barge and rail transportation are competitive in terms of cost, and cleaner in terms of pollutant emissions. Slurry pipeline is by far the cleanest mode, however, drawbacks arise in terms of long distance transportation and the necessity of long-term commitments (Commonwealth of Kentucky 1975).

At the present time, deliveries from one of the potential suppliers would involve truck transportation of coal from the mine to Ashland, Kentucky, where it will be loaded onto barges for delivery at the Ghent Station. However, as transportation costs change, it is possible that Kentucky Utilities will change to having the coal shipped by unit train to a barge loading company next to the Ghent Station, transferred to a barge and then unloaded from the barge to the plant coal storage yard. As Unit 4 comes on-line, it is also possible that it will become economically feasible for rail car unloading facilities to be built at the Ghent Station for direct unloading.

4.3.6 Condenser Cleaning Alternatives

At the present time, no condenser cleaning agents are used. However, at such time as cleaning of fouling organisms becomes necessary, it is planned that chlorine will be used. An alternative method involves mechanical cleaning. Although varying forms of this method are in use today, they tend to have a higher rate of damage to condenser tubing than do chemical treatment methods (Nichols 1974). For this reason, chlorination will be the preferred method for the proposed Units 3 and 4.

4.3.7 Waste Treatment Systems

The method chosen for treatment of domestic and chemical waste at the Ghent Station is outlined in Section 3.3.3. Few practical alternatives to this system exist since no existing municipal system is near enough to tie into. A packaged secondary sewage system is installed and in operation. The discharge is directed to the ash pond.

4.3.8 Air Emission Control System

To meet emission standards prescribed by USEPA and the State of Kentucky, levels of SO_2, particulates and NO_X may not exceed certain limits set by these agencies to insure the health and well being of the surrounding community. To meet these standards, only particulates need an air pollution removal device. Since the chosen electrostatic precipitator removes the particulates to meet standards, no alternatives are considered.

4.4 TRANSMISSION LINE ALTERNATIVES

4.4.1 No Action

If the proposed transmission line was not to be constructed, the Company's Central Service Area would not receive the additional extra high voltage support that is needed by the 1980's. Nor would it solve the loss of the double circuit 345 kV tower line resulting in overloading on several other facilities. This causes a cascading of outages with a loss of the entire station (see section 1.2.6, Transmission Line Rationale).

4.4.2 Action

Upgrading of the existing Indiana tie facilities that could become overloaded would insure against the cascading of outages, as would be true if a 345 kV line were constructed to East Kentucky Power Cooperative's Spurlock Station, Cincinnati Gas and Electric's East Bend Station or Louisville Gas and Electric's proposed station in Trimble County. However, the EHV support needed in the Central Service Area would not be supplied by either of these lines.

Constructing a second 345 kV line from Ghent to West Lexington would provide the required additional outlet at Ghent and support to the Lexington area. However, its construction would duplicate an existing line and provide no potential for support in other areas such as Frankfort and Shelbyville. These areas will require additional support in the middle 1980's.

Transmission lines will not be placed underground in any location because of the high voltages involved, which can cause technical problems (e.g., conductor heating), and because of additional cost. The Federal Power Commission (1971) reported that the cost of an underground line in a rural area is about 19 times that of an overhead facility providing equivalent capacity.

4.4.3 Corridor Route Alternatives

Two possible routes, labeled "A-E" and "C-D" were considered along with the preferred route labeled "A to West Frankfort" (see Figure 2.3-5). Route descriptions and reasons for their elimination as possible choices will be presented in the following sections.

4.4.3.1 "A-E" Route

This route, as well as the preferred and alternate routes, are shown as a solid black line from the Ghent plant to point "A". This section is approximately 5.2 miles long. From point "A", this route runs parallel and adjacent to two existing lines from Ghent to West Lexington in a corridor requiring a 100 ft additional right-of-way (Figure 4.4-1) for a distance of approximately 22.4 miles to point "E", then in a southwesterly direction for a distance of 17.6 miles to a proposed substation 5 miles west of Frankfort (see Figure 2.3-5).

Although this route uses the least amount of total acreage (654.5 acres), it would have considerable adverse effect on the people living adjacent to the existing right-of-way. Eleven residences would have to be moved and 9 barns and one silo destroyed to provide space adjacent to the existing lines for a new construction. This route would also be the least reliable as there would be three major circuits subject to loss from natural disturbances.

The following terrestrial, historical and archaeological findings give further reasons agianst selection of this route. Widening of the existing corridor between points A to E will affect wooded tracts between Pleasant Home and Monterey, Kentucky (T4). This line will also come within one mile of three historical structures (H2, 3 and 4) (see Figure 2.3-3), and either traverse or lie within a mile of the following known archaeological sites: (OW1, 2 and 11, and FR18, 19, 26, 28, 52, 54, 55, 56, 57, 58 and 59) (see Figure 2.3-2).

4.4.3.2 "A-C" Route

This route leaves point "A" in a direction approximately south 10° west for a distance of about 10.8 miles across country to point "C" intersecting the

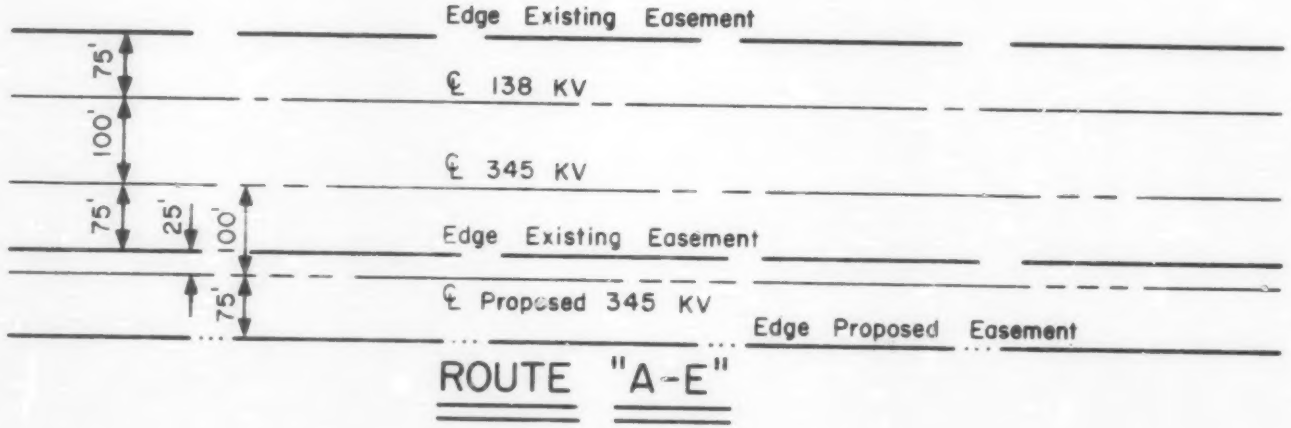

Figure 4.4-1. Existing transmission line corridor and additional 100 ft right-of-way required for the alternate "A-E" route.

existing right-of-way of the Carrollton-Frankfort 138 kV line, then runs parallel with the above line and adjacent to it requiring a 100 ft additional right-of-way (Figure 4.4-2) for a distance of approximately 17.2 miles to point "D" then leaves the Carrollton-Frankfort 138 kV line in a southwesterly direction approximately 11.6 miles to a proposed substation about 5 miles west of Frankfort (see Figure 2.3-5).

The route is second largest in acreage (678.8 acres) and would have considerable adverse effect on the people living adjacent to the existing right-of-way. Six residences (two on the east side and four on the west side) would have to be moved and four barns (two on each side) destroyed to provide space for adjacent construction to the existing right-of-way for a new construction.

Although no historical sites were located along this right-of-way, the terrestrial and archaeological findings described below suggest this route's elimination as a possible choice. From point A to C, the route will dissect a wooded tract on top of a hill 1-1/2 miles southeast of Worthville, Kentucky (T5) (see Figure 2.3-3). Also, 18 known archaeological sites (OW6 and 7; HY3 and 4; and FR3, 7, 11, 18, 19, 26, 28, 52, 55, 56, 57, 58, 59 and 60) will be traversed by or fall within a mile of the route (see Figure 2.3-2).

4.4.4 Alternate Construction Methods

Conventional construction methods using standard transmission line equipment will be used in constructing the proposed line as the terrain traversed by this route does not require special methodology.

The steel towers will be standard height for this class line, utilizing standard vegetation removal as described in Section 3.8.2.4.1. No alternative towers were considered because the tower type now in use by Kentucky Utilities is best suited for the type of terrain and is of good quality, thus requiring low maintenance. At present, the towers are being utilized in a 345 kV transmission line now under construction from Ghent to West Lexington.

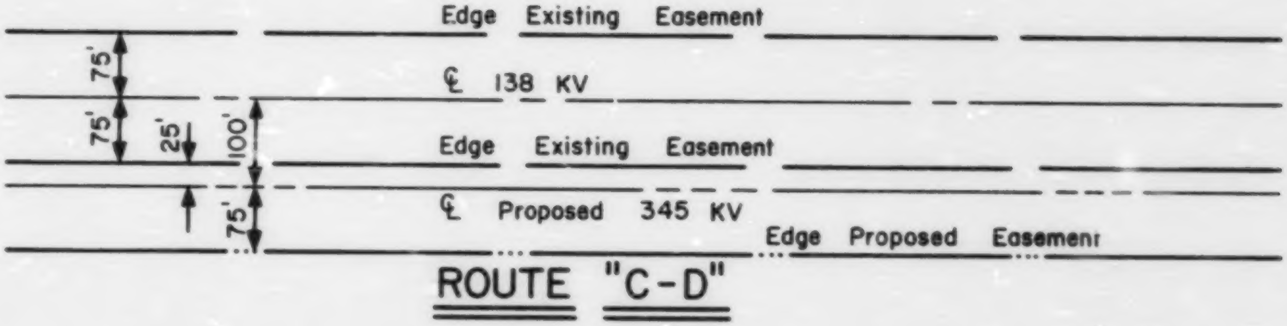

Figure 4.4-2. Existing transmission line corridor and additional 100 ft right-of-way required for the alternate "C-D" route.

4.4.5 Alternate Maintenance Methods

Herbicides will be used to maintain the right-of-way and would be applied by the selective ground basal spraying method. Use of light farm tractors (e.g., brush hogs) and hand cutting equipment may be employed as an alternative method around aesthetically sensitive areas (e.g., roadways, streams).

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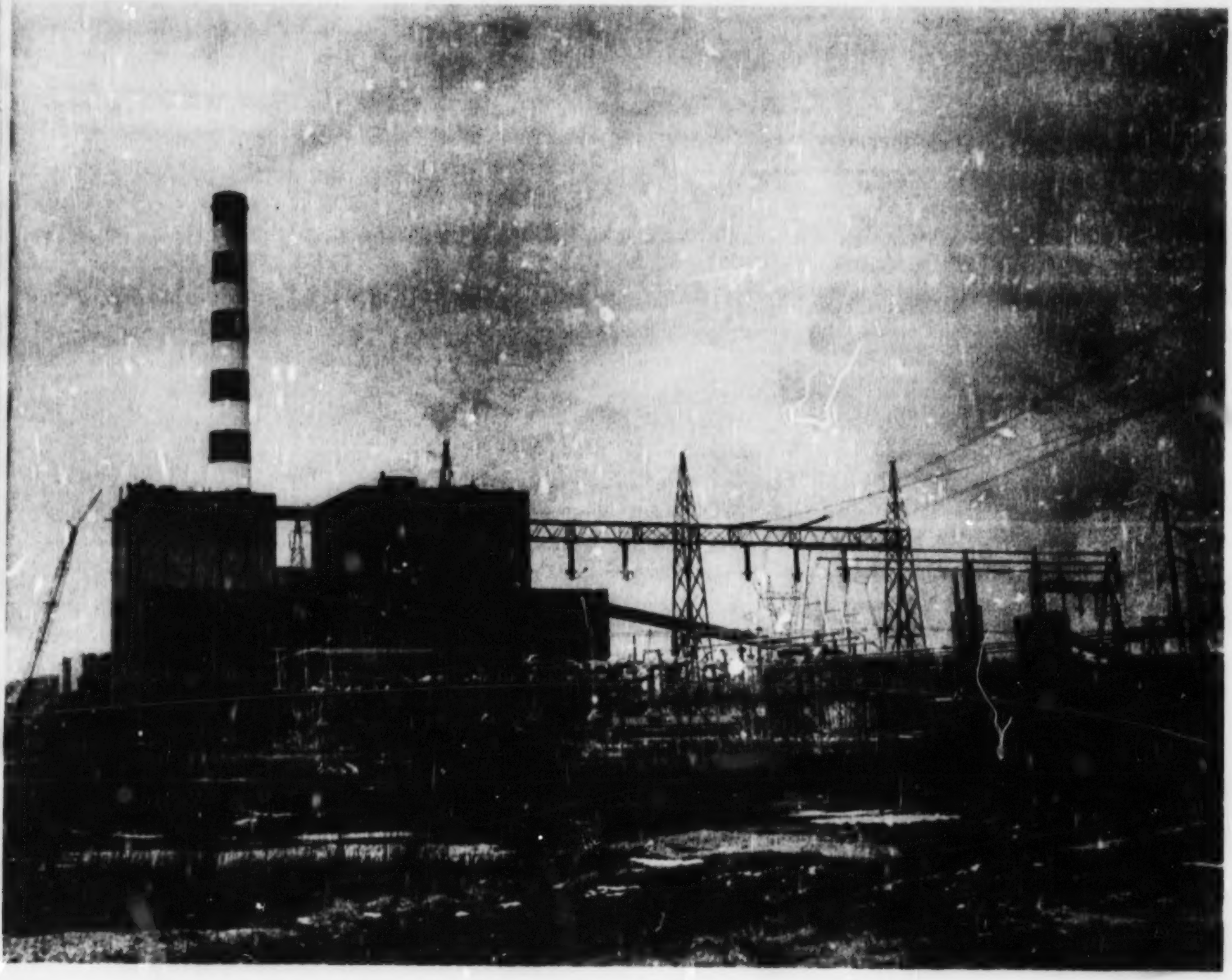

SECTION 5.0

ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

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5.1 ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND FACILITIES CONSTRUCTION

5.1.1 Effect on Land Use

Unavoidable adverse environmental effects will be caused by the construction of Units 3 and 4 at the existing Ghent Station. It is predicted, however, that these effects will be minimal due to the fact that the majority of the land on which the new construction will be located is already cleared and has been used as a materials lay-down for the construction of Unit 2.

The only major structure that will occupy previously uncleared land is the coal storage yard expansion. Clearing areas of natural vegetation cover, disposing of trash and brush, excavating and landfill activities during construction will alter the existing terrain and wildlife habitats. Soil and vegetative cover will also be disturbed by associated roads, lay-down and other activities near the construction site.

The vegetative communities present in the 13.3 acre area of planned coal yard expansion range from pastureland to invaded pastureland to some river bank communities. Dominant vegetative forms consist of American sycamore, black locust, American elm, hackberry and sugar maple.

Wildlife populations within the construction area will be displaced or eliminated depending upon the mobility of the organism, availability of alternate habitat in the vicinity, weather conditions during the clearing phase, accident rates, predation rates and disease rates. Common animals affected include cottontailed rabbits, bobwhite, opossums, gray squirrels, fox squirrels and ruffed grouse. Forced emigration of wildlife populations are never without mortalities or adverse impacts. The adverse impacts in this case, however, are small due to the relatively small area that will be affected by construction.

The general construction at the station will also result in the unavoidtable temporary and permanent loss of some feeding and nesting habitats for birds. Noise from construction and presence of humans may cause some birds to leave portions of the station property. However, none of these habitats are unique or valuable for nesting and most of the displaced birds should find similar habitats adjacent to the site.

The general area of the proposed coal yard expansion contains several buildings and a cemetery. The cemetery and a barn date back to the early 19th century and will not be affected by construction. The archaeological survey performed in this area uncovered a possible significant site. However, further testing demonstrated that the site was indeed neither significant nor worthly of further study (see Section 2.1).

5.1.2 Effect on Water Use

Since the Ghent Station is located on the floodplain of the Ohio River, construction effects on water use are expected primarily from temporary erosion of disturbed ground cover and from construction of the intake and discharge structures. Erosion will cause an increased load of suspended solids in the Ohio River that may adversely affect aquatic life by decreasing light penetration, silting over substrates, increasing abrasion, and clogging respiratory organs. Fish, however, can be expected to avoid areas of high silt concentration, thus minimizing the effects on this important group.

Some disruption of ground cover involved in the construction of the switchyard, parking lot and transmission line facilities may cause increased siltation in small creek that empties into Black Rock Creek. Since the area in which this construction occurs is less than 95 acres of low slope land and six percent of the total Black Rock Creek drainage area, the effects are considered to be both temporary and small. A buffer zone of vegetation will be left between construction areas and the creek to reduce the amount of siltation entering the creek.

The enlargement of the coal storage yard will involve the construction of a drainage ditch surrounding it. This ditch will eventually be used to drain the yard into a sedimentation basin and thence to the existing ash pond. This ditch will also minimize run-off during the construction period.

The construction of the intake and discharge system will affect approximately 100 ft of the river bank. Construction of these structures will adhere to the requirements of the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. A description of construction is outlined in Section 8.0.

The foundation of the intake structure will be built inside a cofferdam and, therefore, siltation due to construction will be minimal. The construction of the discharge structure will cause some temporary erosion of the bank. However, as the construction is completed, 650 cubic yards of riprap and 320 cubic yards of bedding will be used to control the erosion.

During construction of the main plant building, the rainwater run-off will be collected in the excavation hole and pumped to Unit 2 auxiliary sump and then pumped to the ash pond. Construction materials for Units 3 and 4 will be stored in a lay-down area west of the construction site. Sheet run-off from this area drains into a small tributary of Black Rock Creek. Significant changes in run-off is not expected.

Other areas of the site will be graded and seeded as much as practicable to minimize erosion. Essentially, the practices outlined in the USEPA document 430/9-73-007 Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity will be followed.

5.1.3 Resources Committed

5.1.3.1 Land Resources

No new land will be purchased for the construction of Units 3 and 4 other than for transmission line rights-of-way. Approximately 60 acres of previously cleared or otherwise disturbed land that is within the station property will be used for new construction.

Existing wildlife will sustain some mortalities as a result of construction activities and survivors will be forced to emigrate from the disturbed area. However, due to the relatively small amount of land impacted by construction, the effect of the loss or emigration of wildlife is not serious.

5.1.3.2 Building Materials

The usual life of project equipment and materials is estimated to be about 35 years. Based on previous experience, Kentucky Utilities expects after this time to decommission and dismantle the plant so that materials that were committed for electrical generation can possibly be recycled for use in other applications.

5.2 ENVIRONMENTAL EFFECTS OF PLANT OPERATION

This section involves the adverse and beneficial environmental effects of operation of the proposed Units 3 and 4 at the Ghent Station. Topics discussed will include impacts on the aquatic environment from thermal and chemical discharges, impacts on the terrestrial environment of plant stack emissions and impacts on the sociological and economic framework of the region from plant operation. The same topics will also be addressed concerning the proposed transmission line from the Ghent Station to West Frankfort.

5.2.1 Effects on the Aquatic Environment

As stated in Section 3, two point discharges will result from operation of Units 3 and 4. One will consist of discharge of service water near the proposed intake structure and another will consist of the discharge of a combined set of effluents from the existing ash pond. The ash pond effluents will be composed of low-volume waste, chemical treatment effluent, cooling tower and boiler blowdown, effluent from the domestic waste treatment system, and discharge from the ash sluice system.

5.2.1.1 Thermal and Chemical Standards

The thermal standards applicable to waste water discharges from the Ghent Station Units 3 and 4 are discussed in this subsection. Three sets of standards have been promulgated, each by a different regulatory agency:

a. the Federal Environmental Protection Agency's final effluent limitations under the Federal Water Pollution Control Act Amendments of 1972;

b. the State of Kentucky's water quality standards, Kentucky Water Pollution Control Commission Regulation WP-4-1; and

c. the Ohio River Valley Water Sanitation Commission's standards, ORSANCO Pollution Control Standard No. 2-70.

Applicable chemical standards are outlined in 40 CFR Part 423, EPA Effluent Guidelines and Standards for Steam Electric Power Generating Point Source Category. These standards are presented in Table 5.2-1. The thermal requirements for 40 CFR Part 423 have, however, been totally remanded and set aside by the U.S. Court of Appeals for the Fourth Circuit on July 16, 1976. This ruling previously stated that there shall be no discharge of heat from the main condensers except for heat discharged in blowdown from recirculated cooling water systems. Thermal standards as appear in the draft NPDES permit are derived from the Kentucky Water Quality Standards.

Kentucky water quality standards state:

a. the maximum temperature for the Ohio by month:

Month	Ohio River (F)
January	50
February	50
March	60
April	70
May	80
June	87
July	89
August	89
September	87
October	78
November	70
December	57

b. the maximum temperature rise at any time or place above natural temperatures shall not exceed 5F in streams;

c. mixing zones shall be determined on a case-by-case basis--Kentucky Regulation EP-4-1, Section 3(3) states that the mixing zone shall be as small as possible and shall not prevent the free passage of fish and drift organisms;

Table 5.2-1

U.S. Environmental Protection Agency
Standards of Performance for New Sources:
Maximum Allowable Discharge Concentrations by Waste Source[1,2]

	Effluent Characteristics														
Waste Source	Total Suspended Solids		Oil and Grease		pH	PCB[4]	Copper, Total		Iron, Total		Free Available Chlorine[5]		Zinc, Chromium, Phosphorous and Other Corrosion Inhibitors		Heat
	Daily Max.[3]	Daily Ave.[3]	Daily Max.	Daily Ave.	Allowable Range		Daily Max.	Daily Ave.	Daily Max.	Daily Ave.	Max. Instantaneous	Chlorination Period Ave.	Daily Max.	Daily Ave.	
1. All discharges					6.0-9.0	ND[6]									
2. Low volume wastes[7]	100mg/ℓ	30mg/ℓ	20mg/ℓ	15mg/ℓ											
3. Bottom ash transport water[8]	100mg/ℓ	30mg/ℓ	20mg/ℓ	15mg/ℓ											
4. Fly ash transport water	ND[6,9]	ND[6,9]	ND[6,9]	ND[6,9]											
5. Metal cleaning wastes and boiler blowdown	100mg/ℓ	30mg/ℓ	20mg/ℓ	15mg/ℓ			1.0mg/ℓ	1.0mg/ℓ	1.0mg/ℓ	1.0mg/ℓ					
6. Cooling tower blowdown[10]											0.5mg/ℓ	0.2mg/ℓ	NDA[6]	NDA[6]	
7. Main condenser															ND[6,9,11]
8. Material storage runoff[12]	50mg/ℓ	50mg/ℓ													
9. Construction runoff[12]	50mg/ℓ[9]	50mg/ℓ[9]			6.0-9.0										

[1] The quantity of pollutants discharged from waste sources 1-6 shall not exceed the quantity determined by multiplying the flow from the waste source times the concentration in the table.

[2] In the event that waste streams from various sources are combined for treatment or discharge, the quantity of each pollutant or polluted property attributable to each controlled waste source shall not exceed the specified limitation for that waste source.

[3] Daily Maximum: Maximum 24-hour value; Daily Average: Average value for 30 consecutive days.

[4] PCB: Polychlorinated biphenyl compounds.

[5] Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than two hours in any one day and not more than one unit in any plant may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the Regional Administrator that the units in a particular location cannot operate at or below the level of chlorination.

[6] NDA: No detectable amount and ND: No discharge.

[7] Include, but are not limited to waste waters from wet scrubber air pollution control systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, floor drainage, cooling tower basin cleaning wastes, and blowdown from recirculating house service water systems.

[8] The quantity of pollutants discharged in bottom ash transport water shall not exceed the quantity determined by multiplying the flow of bottom ash transport water times the above concentrations and dividing the product by 20.

[9] Limitations remanded and set aside by the United States Court of Appeals for the Fourth Circuit on 16 July 1976.

[10] Blowdown shall mean the minimum discharge of recirculating cooling water for the purpose of discharging materials contained in the process, the further buildup of which would cause concentrations or amounts exceeding limits established by best engineering practice.

[11] There shall be no discharge of heat from the main condensers except heat may be discharged in blowdown from recirculated cooling water systems provided the temperature at which the blowdown is discharged does not exceed at any time the lowest temperature of recirculated cooling water prior to the addition of the makeup water.

[12] Any untreated overflow from facilities, constructed, and operated to treat the volume of material storage runoff and construction runoff which results from a 10-year, 24-hour rainfall event shall not be subject to the pH and total suspended solids limitations stipulated for this waste source.

pH measured in standard units
mg/ℓ - milligrams per liter

Source: U.S. Environmental Protection Agency "Steam Electric Power Generating Point Source Category: Effluent Guidelines and Standards," Federal Register, Vol. 39, No. 196, 8 October 1974. 40 CFR Part 423.

d. the normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained; and

e. that above subsections a, b and d shall apply at the edge of the mixing zone.

The ORSANCO Pollution Control Standard No 2-70 regulates the amount of heat that may be discharged to the Ohio River by the following formula:

Allowable heat-discharge rate (BTU/sec) =
62.4 x the river flow (cfs) x $(T_A - T_R)$ x 90%

where:

T_A = allowable maximum temperature (°F) in the river as specified in Kentucky water quality standards

T_R = river temperature (daily average in °F) upstream from the discharge

River flow = measured flow but not less than 11,900 cfs

In no case shall the heat-discharge rate result in a calculated increase in river temperature of more than 5F.

The Kentucky water quality standards were approved by the Region IV EPA Administrator on February 28, 1974 in accordance with the Federal Water Pollution Control Act.

Kentucky is a signatory of the Ohio River Valley Sanitation Compact. However, since the ORSANCO standards are identical to or less stringent than the Kentucky water quality standards, compliance with the latter will satisfy the former.

The water quality standards of no other state is applicable to this discharge.

5.2.1.2 Physical Effects on the Ohio River

Since the Ghent Station utilizes off-stream cooling for all its generating units, the thermal effects that have been historically associated with power plants with once-through cooling will not be present at the Ghent Station. Three discharges with a total flow of 72.5 cfs are expected upon completion of Units 3 and 4. Only two of these, a service water discharge (29.8 cfs) and the ash pond discharge (23.2 cfs) are associated with the operation of Units 3 and 4.

A flow averaging approximately 13,372 gpm (29.8 cfs) will be expected from the service water discharge structure. The temperature of this water may be elevated as high as 10F above ambient Ohio River water. The area impacted by this thermal effluent will be relatively small since it will only make up .25 percent of historic low flow (11,900 cfs) of the Ohio River at Ghent.

A somewhat smaller discharge is anticipated from the ash pond, which combines the effluents from the operation of all four units. This flow is anticipated to be 10,428 gpm (23.2 cfs), which is .20 percent of historic low flow of the Ohio River. The temperature of the final ash pond effluent after all four units are operational is difficult to predict. Not only does this temperature depend on the temperature of the cooling tower blowdown entering the ash pond but also the residence time of the ash pond, and climatic conditions such as humidity, solar radiation, wind speed, air temperature and precipitation. The temperature rise above ambient river temperature of this discharge is expected to be 5F or less under normal conditions. Under worst-case conditions, particularly in the winter months, the temperature rise may be greater but it is expected never to exceed a 21.3F rise.

In order to assess the impact of the three thermal discharges, predictive modeling was performed as outlined in EPA's Workbook of Thermal Plume Prediction, Vol. 2, Surface Discharge, May 1974. To simulate worst-case conditions, the highest expected ΔT and lowest expected Ohio River flow was used. As a comparison, a hypothetical case was also modeled incorporating parameters of a plant of the same size as Units 3 and 4 but with once-through cooling. Results are presented in Table 5.2-2.

Table 5.2-2

Worst-Case Plume Configuration (5F delta) Under Low Flow Conditions* and Maximum Initial ΔT

	Discharge	Initial ΔT	Flow Rate (cfs)	Maximum Downstream Distance	Maximum Offshore Distance	Area of 5F Delta (ft^2)
Ash pond	001	21.3F***	23.2	197 ft	121.9 ft	19,600
Service water Units 1 and 2	002	10F	19.5	12.6 ft	28.4 ft	200
Service water Units 3 and 4	008	10F	29.8	12.6 ft	28.4 ft	200
Once-through cooling**		20F	1262	352.7 ft	620.7 ft	99,500

Source: USEPA 1974. Workbook of Thermal Plume Prediction, Volume 2, Surface Discharge.

* Assuming Ohio River at 7-day, 10-year low flow condition, 11,900 cfs.

** Hypothetical--for 1000 MW plant.

*** Reflects the maximum rise above ambient Ohio River temperature of the ash pond discharges from Cincinnati Gas and Electric's Miami Fort and Beckjord Plants. (1972-1974). Source: East Bend Unit 1 and 2 EIS, USCOE, Louisville District.

Figure 5.2-1 presents the predicted nature of the three Ghent Plant plumes under worst-case conditions. It can be seen that the 5F ΔT mixing zones of the three plumes will displace very little area of the Ohio River and not interact.

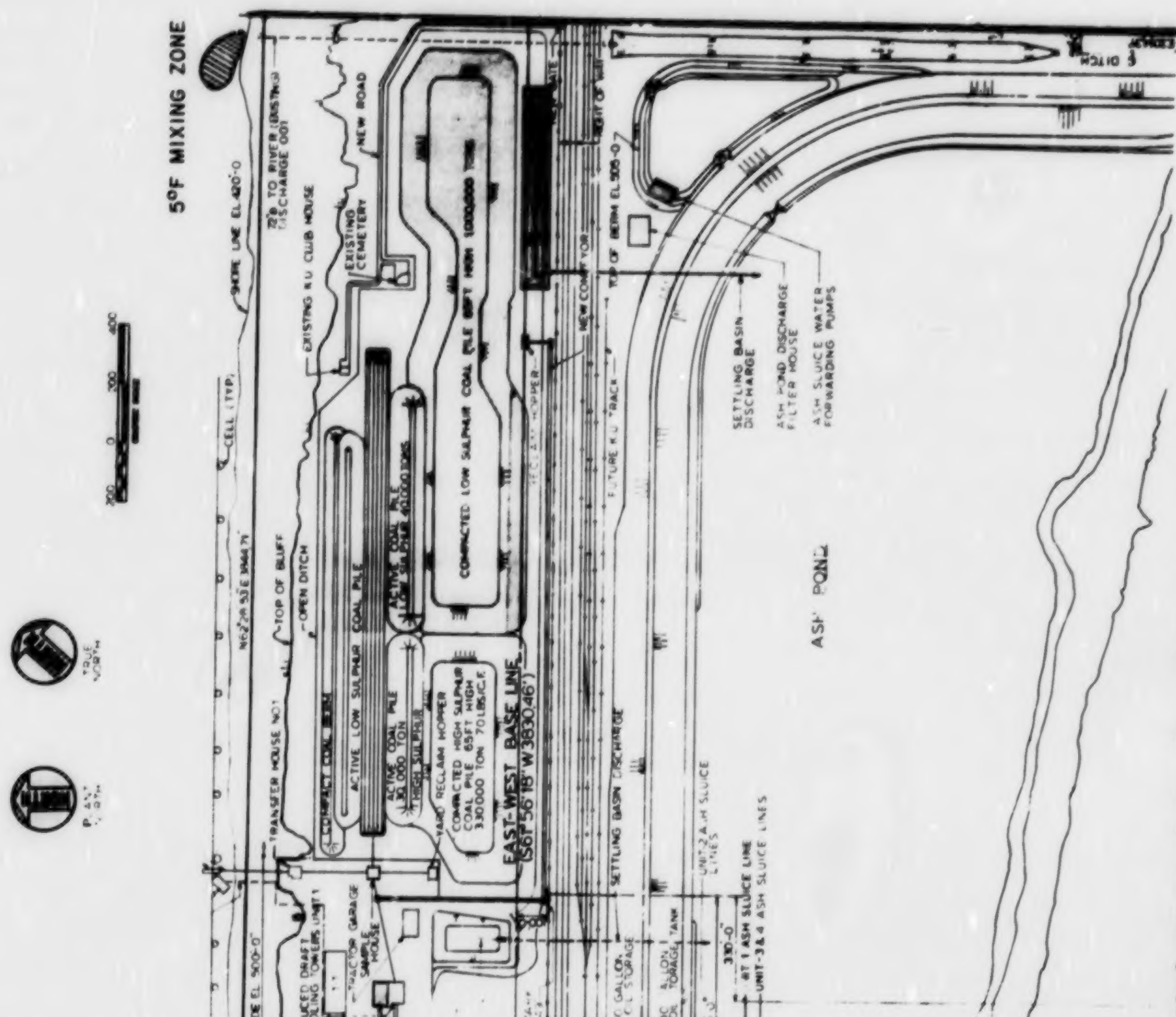

Figure 5.2-1. Predicted nature of the three Ghent Plant plumes under worst-case conditions.

5.2.1.3 Effects of Released Heat on the Aquatic Biota

The effects of released heat from steam electric power plants have been studied for some time. It has been determined that off-stream cooling is a desirable means to reduce the impacts of released heat on the aquatic environment. Since the Ghent Station will utilize cooling towers to dissipate the majority of the heat produced in the production of electricity, the amount of released heat affecting the aquatic biota will be minimal and localized around the discharge structures.

At the present time, the Ohio River appears to be favorable (in temperature) for spawning by the emerald shiner, channel catfish, largemouth bass, freshwater drum and blue catfish. The channel catfish population would be enhanced by higher temperatures and the sauger population is already limited by existing or higher temperatures (Table 5.2-3) (ORSANCO 1975).

As one looks at the possible effects resulting from a low-volume heat discharge from the Ghent Station, it can be seen that it will not contribute significantly to overall changes that are presently occurring in the Ohio River. Studies carried out by Wapora (1975) have shown that fish which favor a tnermal discharge will move toward it and those which favor cooler water will move away. In the case of the Ghent Station, where the maximum percent of the Ohio River flow which is taken up by the discharge is only 0.5 percent, cooler water species will easily avoid it.

Due to the low abundance of shallow areas or weeds suitable for nesting in the main stem of the Ohio River, much of the spawning of fish presently takes place in small creeks and other tributaries to the Ohio River (ORSANCO 1975). Therefore, the possibility of the discharge of the Ghent Station upsetting natural patterns of spawning along the river bank is remote.

The impact upon phytoplankton and zooplankton by the Ghent Station's thermal discharge is predicted to be negligible.

Table 5.2-3

Recommended Temperature Limits for Fish

Species	Temperature				Ultimate Upper Incipient Lethal Temperature		Maximum Weekly Average Temperature	
	Spawning		Optimum					
	°C	°F	°C	°F	°C	°F	°C	°F
Black crappie	20.0	68.0						
Bluegill	19.4	66.9	22.0	71.6	33.8	92.8	25.9	78.6
Carp	19.0	66.2						
Channel catfish	26.7	80.1	30.0	86.0	38.0	100.4	32.7	90.7
Emerald shiner	15.6	60.1	27.0	80.6	30.7	87.3	28.2	82.8
Freshwater drum	23.0	73.4						
Largemouth bass	15.6	60.1	27.5	81.5	36.4	97.5	30.5	86.7
Sauger	5.0	41.0						
Smallmouth bass	18.9	66.0						
Gizzard shad	16.7	62.1			34.5	94.1		

Water Quality Criteria--1972, EPA-R3-73-033, Appendix II-C.

5.2.1.4 Effects of Chemical and Biocide Discharges

The service water discharge will remain chemically unchanged through its cooling cycle. Slight depression of dissolved oxygen concentrations may result through the heating of the water but because of the low discharge volume, not enough to cause any ill effects on the aquatic biota.

Discharge from the ash pond will vary significantly from ambient Ohio River water. The concentration of dissolved and suspended solids is increased significantly resulting from evaporation in cooling tower operation, unsettled fly and bottom ash from Units 1 and 2, boiler blowdown and regenerant wastes from boiler demineralizers. A generalized list of properties found originating from fossil fuel power plant waste streams is presented in Table 5.2-4. Due to the small amount of discharge compared to the flow of the Ohio River, the effects of dissolved oxygen and suspended solids will be minimal at the discharge.

Chlorination will be used to reduce bacteria after sewage treatment and also, when necessary, to reduce biological growth in the cooling water systems. Chlorine used in the condenser cooling system will be discharged into the ash pond. Due to the estimated long retention time (6.9 days) of the ash pond, free chlorine should be removed through chlorine demand, heating and aeration. No detectable amount of chlorine will be discharged into the Ohio River from the ash pond.

Chlorine will be used in the service water system which discharges directly into the Ohio River. The draft NPDES permit (see Section 8) limits this discharge to 0.3 mg/ℓ instantaneous and 0.2 mg/ℓ one-hour average concentration of residual chlorine at the point of discharge. The concentration will be reduced to less than 0.1 mg/ℓ within 30 ft of the point of discharge. Table 5.2-5 presents information on the effect of chlorine on indigenous fish species of the Ohio River. By operating within the limits of the draft NPDES permit, little impact is expected from chlorine additions.*

* If the effluent limitation on chlorine is not obtainable after an initial demonstration period, dechlorination equipment will be added. The company has the option, as biological toxicity data become available, to submit a demonstration showing that discharge of higher levels of chlorine are consistent with Kentucky Water Quality Standards.

Table 5.2-4

General Properties of Power Plant Waste Streams

Parameter	Condenser Cooling System		Water Treatment				Chemical Cleaning								
	Once-through	Recirculating	Clarification Wastes	Ion Exchange Wastes	Evaporator	Boiler Blowdown	Boiler Tubes	Air Pre-heater	Boiler Fireside	Ash Pond Overflow	Coal Pile Drainage	Floor Drains	Air Pollution Devices SO_2 Removal	Sanitary Wastes	Load Rad Wastes
Alkalinity	x	x	x	x	x	x	x	x	x	x			x		
BOD		x	x	x	x	x	x	x		x		x	x	x	
COD		x	x	x	x	x	x	x	x	x		x		x	
TS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
TDS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
TSS		x	x	x	x	x	x	x	x	x	x	x	x	x	
Ammonia		x	x	x	x	x	x	x	x	x	x			x	
Nitrate		x	x	x	x	x	x			x	x			x	
Phosphorus		x	x	x	x	x	x			x	x		x	x	
Turbidity		x	x		x	x	x	x	x	x	x	x	x	x	
Fecal Coliform														x	
Acidity							x	x	x	x	x	x	x		
Hardness, Total		x	x	x	x	x	x			x		x	x		
Sulfate		x	x	x	x	x	x	x	x	x	x	x	x		
Sulfite								x	x	x		x	x		
Bromide							x								
Chloride		x	x		x	x	x	x	x	x	x			x	
Fluoride		x	x	x			x			x					
Aluminum		x	x		x	x	x		x	x	x		x		
Boron															x
Chromium		x	x	x	x	x	x	x	x	x	x				
Copper	x	x	x	x	x	x	x	x	x	x	x				
Iron		x	x	x	x	x	x	x	x	x	x		x		
Lead										x	x	x			
Magnesium		x	x	x	x	x	x	x	x	x	x	x	x		
Mercury				x	x		x			x	x				
Nickel		x	x	x	x	x	x	x	x	x	x				
Selenium							x			x	x				
Vanadium									x	x			x		
Zinc		x	x	x	x	x	x			x	x				
Oil & Grease				x			x			x		x	x		
Phenols		x	x		x					x	x				
Surfactants					x		x			x		x		x	
Algicides	x	x												x	
Chlorine	x	x													
Manganese		x		x	x	x	x		x	x	x		x		

Note: Miscellaneous streams such as laboratory sampling, stack chemical cleanings. etc. are not included since the parameters are accounted for in other streams.

Table 5.2-5

Chlorine Effect on Fish Species of the Ohio River

Common Name	Scientific Name	Chlorine Concentration (mg/ℓ)	Duration (hrs)	Effect	Reference
Herrings	Clupeidae				
Gizzard shad	Dorosoma cepedianum	0.62	1/6	Some mortality	Truchan and Basch 1971
Minnows and carps	Cyprinidae				
Goldfish	Carassius auratus	0.27	24	50% mortality	Dickson and Cairns 1975
Carp	Cyprinus carpio	0.72	1	Some mortality	Truchan and Basch 1971
Bluntnose minnow	Pimepheles notalus	0.7	1	100% mortality	Hubbs 1930
Emerald shiner	Notropis atherinoides	0.3	1/2	50% mortality	Collins 1976
E. blacknose dace	Rhinichthys a. atratulus	0.7	1-1/3	100% mortality	Hubbs 1930
Suckers	Catostomidae				
White sucker	Catastomus commersoni	1.0	1	100% mortality	Forbes 1971
Catfishes	Ictaluridae				
Channel catfish	Ictalurus punctatus	0.09	96	50% mortality	Roseboom and Richey 1975
Livebearers	Poeciliidae				
Mosquito fish	Gambusia affinis	0.5-1.0	72	Mortality threshold	Gromov 1944
Sunfishes	Centrarchidae				
Green sunfish	Lepomis cyanellus	2.0	24	60% mortality	Panikkar 1960
Bluegill	Lepomis macrochirus	0.52	75	50% mortality	Bass and Heath 1975; Heath 1974
Smallmouth bass	Micropterus dolomieui	0.5	15	50% mortality	Pyle 1960
Largemouth bass	Micropterus salmoides	0.494	24	50% mortality	Arthur et al. 1975
Black crappie	Pomoxis nigromaculatus	1.36	1/2	Some mortality	Truchan and Basch 1971
Perches	Percidae				
Yellow perch	Perca flavescans	0.365	12	50% mortality	Arthur et al. 1975
Walleye	Stizostedion vitreum vitreum	0.267	12	50% mortality	Arthur et al. 1975

5.2.1.5 Effects of Intake Structure

The operation of the intake structure can result in an adverse impact on the aquatic biota of the source water. Impingement of juvenile and adult fishes on traveling intake screens can occur depending on the following factors:

a. velocity of water intake

b. swimming capability of each species (which varies with size, physiological condition, water temperature and amount of dissolved oxygen in the water)

c. location of the intake structure

The proposed intake structure will be almost identical to the existing structure for Units 1 and 2. Geo-Marine, Inc. (1976) has recently completed a year-long impingement study of this structure. A total of six fish weighing 1.2 lbs were collected during 28 separate 24 hr long biweekly samplings. This low rate of impingement probably results from the low velocity of water at the point of intake (0.83 fps), which most fish can avoid. Also, the location of the structure is on the Ohio River, not on tributaries where a greater abundance of water swimming juvenile fishes would be located. Lower impingement results can be expected from the new structure due to a lower intake velocity rate (0.48 fps).

5.2.1.6 Effects of the Discharge Structure

No significant impact on the aquatic biota of the Ohio River is expected to result from the operation of the three discharge structures at the Ghent Station.

5.2.1.7 Effects of Condenser Passage

Organisms such as fish eggs and larvae, zooplankton, phytoplankton and drifting macroinvertebrates are susceptible to entrainment by the condenser cooling system. Mortality approaching 100 percent may occur due to thermal, mechanical, pressure and biocide shocks during circulation in the condenser cooling system (Jensen et al. 1969; March 1975).

The total effect of condenser passage of organisms of the Ohio River will be small due to the low rate of water intake from the river. It is anticipated that Units 3 and 4 will require a normal rate of 25,068 gpm of water intake. At the historic low flow of the Ohio River, this rate amounts to 0.5 percent of the river flow used for cooling water. This small flow of intake water relative to the river flow indicates that no significant ecological impact can be expected from mortality in condenser passage.

5.2.2 Effects on the Terrestrial Environment

The primary effects of plant operation on the terrestrial environment will be due to plant stack emissions. Other operating components that will also be discussed in terms of effects on the terrestrial environment will be the cooling towers and the coal handling facilities. Section 5.2.2.4 will discuss general operational effects that may have an impact upon the environment.

5.2.2.1 Air Modeling Program Results

PTMAX and CRS-1

The results of these two programs were obtained from USEPA Region IV, Air Quality Section, Atlanta, Georgia. For each receptor location, each 1 hr and 24 hr average SO_2 concentration at 860 ft MSL elevation for 1964 Louisville meteorological conditions is given. In addition, a summary is presented giving the maximum 1 hr and 24 hr average SO_2 concentration, with the corresponding meteorological conditions, which occurred during the year, at each receptor location. This information was used to further pinpoint the location and value for the maximum SO_2 concentrations with the short-term model (PTMTP-W).

Results of the Short-Term Model (PTMTP-W)

This section is divided into two parts. The first will discuss the short-term model's results in terms of federal and state air quality standards and the second in terms of significant deterioration increment standards (see Table 3.6-1). In each part, applicable 3 hr and 24 hr maximum average concentratins of SO_2 and total suspended particulates are presented. First, concentrations resulting from the Ghent Station as the only source; and secondly, concentrations resulting from the interaction of all significant area-wide sources. (Note: When modeling for the interaction with area-wide sources, day 176 (24 June) from the 1964 Louisville meteorological data was used since it demonstrated the conditions that tend to carry air emissions the farthest distance.) As the results are read, refer to Table 3.6-1 for an overview of applicable state and federal air quality standards.

Short-Term Model Results Applicable to Ambient Air Quality Standards

Table 5.2-6 presents the results of the short-term modeling that was performed with Ghent stacks 1 and 2 as the only sources. The table presents the highest 3 hr and 24 hr average pollutant concentrations found after modeling the days and hours of worst-case dispersion conditions obtained from the CRS-1 program. (Note: Day 208, 26 July 1964, was used for modeling in the Ghent area since it demonstrated worst-case conditions.)

Table 5.2-6

Ghent Stacks 1 and 2, Maximum Average Sulfur Dioxide and Total Suspended Particulate Conditions at 95 Percent Load Factor

Average Concentration Period	Day	SO_2 Concentration in μg/m^3		TSP Concentration in μg/m^3		Receptor Distance from Ghent Station
		Predicted Maximum	Standards	Predicted Maximum	Standards	
3 hr	208*	1137	1300	N/A	N/A	1.8 km
24 hr	208	142.1	365	7.1	260/150**	1.8 km

* Day 208 corresponds to 26 July 1964.

** Primary/Secondary

Table 5.2-7 presents the results of the short-term model that included the interaction of area sources for day 176 of the 1964 Louisville meteorological conditions. The worst-case wind direction can be rotated in this model, so as to carry the emissions of one plant toward another and cause interaction. For these results, the wind direction was rotated so as to come from between the Clifty Creek Plant and Wises Landing Plant and be directed toward the Ghent Plant. This wind direction was found to bring in the largest quantity of outside pollutants to receptors downwind of the Ghent Plant.

Table 5.2-7

Predicted Interaction of Area Sources for Day 176*
with Sources Operating at 95 Percent Load Factor

Average Concentration Period	Sources (Plant)	SO_2 Concentrations in μg/m³		TSP Concentrations in μg/m³		Receptor Distance from Ghent Station (km)
		Predicted Maximum	Primary/ Secondary Standards	Predicted Maximum	Primary/ Secondary Standards	
3 hr	Ghent	395.7	1300	N/A	N/A	4.2
	Wises Landing	5.2				
	East Bend	0				
	Clifty Creek	16.9				
	Total	417.8				
24 hr	Ghent	119.1	365	5.6	260/150	4.2
	Wises Landing	4.2		.5		
	East Bend	0		0		
	Clifty Creek	3.6		.3		
	Total	126.9		6.4		

* Day 176 corresponds to 24 June 1964.

Short-Term Model Results Applicable to Significant Deterioration Increment Standards

Table 5.2-8 presents the results of the short-term modeling that was performed with Ghent stack 2 as the only source. The results represent the maximum 3 hr and 24 hr average pollutant concentration resulting from the Ghent Plant's stack 2. This concentration is also expressed in terms of the maximum percentage of the significant deterioration increment used near the Ghent Station.

Table 5.2-8

Predicted Maximum Average SO_2 and TSP Concentrations for Significant Deterioration Increment from Ghent Station Stack 2 at 95 Percent Load Factor, Day 208

Average Concentration Period	SO_2 Concentrations			TSP Concentrations			Receptor Distance from Ghent Station (km)
	Predicted Maximum ($\mu g/m^3$)	Percent Increment	Standard	Predicted Maximum ($\mu g/m^3$)	Percent Increment	Standard	
3 hr	288	41.1	700	N/A	N/A	N/A	1.8
24 hr	35.2	35.2	100	1.7	8.5	20	1.8

The following tables represent results obtained from short-term modeling indicating interaction from other emission sources which contribute to the significant deterioration increment. These include Wises Landing Plant's two stacks and East Bend Plant's two stacks. Each of the following tables present results obtained by varying the worst-case wind direction in order to account for all worst-case conditions. All results are expressed as the maximum percent of the significant deterioration increment used.

Table 5.2-9 presents the maximum 3 hr increment percentage used by each source by directing the worst-case wind on day 176 from: (1) Wises Landing Plant toward Ghent, (2) Ghent toward Wises Landing, (3) East Bend toward Ghent, and (4) Ghent toward East Bend. Table 5.2-10 is similar to Table 5.2-9 except that 24 hr SO_2 and TSP concentrations are shown.

Table 5.2-9

Predicted 24 hr Average Maximum Significant Deterioration
SO_2 and TSP Increment for Ghent Units 3 and 4,
Wises Landing and East Bend at 95 Percent Load Factor

Wind Direction	Sources	24 hr SO_2 Concentration			24 hr TSP Concentrations			Distance from Receptor Locations
		Predicted Increment ($\mu g/m^3$)	Percent Increment	Standard ($\mu g/m^3$)	Predicted Increment ($\mu g/m^3$)	Percent Increment	Standard ($\mu g/m^3$)	
Wises Landing to Ghent	Ghent	28.5	28.5	100	1.42	7.1	20	4.4 km downwind from Ghent
	Wises Landing	10.6	10.6		1.22	6.1		
	East Bend	0	0		0	0		
	Totals	39.1	39.1		2.64	13.2		
Ghent to Wises Landing	Ghent	6.7	6.7	100	.34	1.7	20	3.9 km downwind from Wises Landing
	Wises Landing	54.4	54.4		1.26	6.3		
	East Bend	1.6	1.6		.32	1.6		
	Totals	62.7	62.7		1.92	9.6		
East Bend to Ghent	Ghent	28.5	28.5	100	1.42	7.1	20	4.4 km downwind from Ghent
	Wises Landing	0	0		0	0		
	East Bend	10.5	10.5		2.10	10.5		
	Totals	39.0	39.0		3.52	17.6		
Ghent to East Bend	Ghent	8.8	8.8	100	.44	2.2	20	3.7 km downwind from East Bend
	Wises Landing	3.0	3.0		.36	1.8		
	East Bend	40.1	40.1		8.02	40.1		
	Totals	51.9	51.9		8.82	44.1		

Results of the Long-Term Model (Terrain Model)

As with the short-term model, the long-term model was utilized to obtain predictions of SO_2 concentrations for indication of compliance with the ambient air quality standards and the significant deterioration increment standards. Results are presented as 70 percent reductions of the computer output illustrating the actual position of each SO_2 concentration in 2 km increments. In order to locate each value, the orientation map (Figure 3.6-1) is enlarged to the same scale and overlayed on the computer printout. The decimal point of each value is its receptor location.

Long-Term Model Results Applicable to Ambient Air Quality Standards

Figure 5.2-1 presents the results of the long-term model's prediction of the annual average SO_2 concentrations due to all area sources operating at 95 percent load in 1983 (OVEC's Clifty Creek Plant, LG&E's Wises Landing Plant, KU's Ghent Plant and CG&E's East Bend Plant). The resulting maximum SO_2 concentrations within the study area is predicted to be 3.61 μg/m³ located due north 14 km* from the Ghent Plant. This value is well under the primary air quality standard of 80 μg/m³ and the secondary air quality standard of 60 μg/m³ (see Table 3.6-1).

Long-Term Model Results Applicable to Significant Deterioration Increment Standards

The Wises Landing Plant, Ghent Stack 2 and the East Bend Plant were used as sources in the long-term model in order to establish the percent of the annual significant deterioration increment each used within the Ghent study area. Figure 5.2-2 shows the maximum annual significant deterioration increment used by the proposed units at Ghent as 0.45 μg/m³ or 3 percent of the 15 μg/m³ increment. This concentration is predicted to occur 14 km due north of the Ghent Plant. Figure 5.2-3 and 5.2-4 likewise show the contribution that Wises Landing and East Bend respectively have in the Ghent Station study area. Maximum SO_2 concentrations from the Wises Landing

* The scale of the output was expanded to cover a 21 km radius. The value of 3.61 μg/m³ remains the maximum SO_2 concentration encountered.

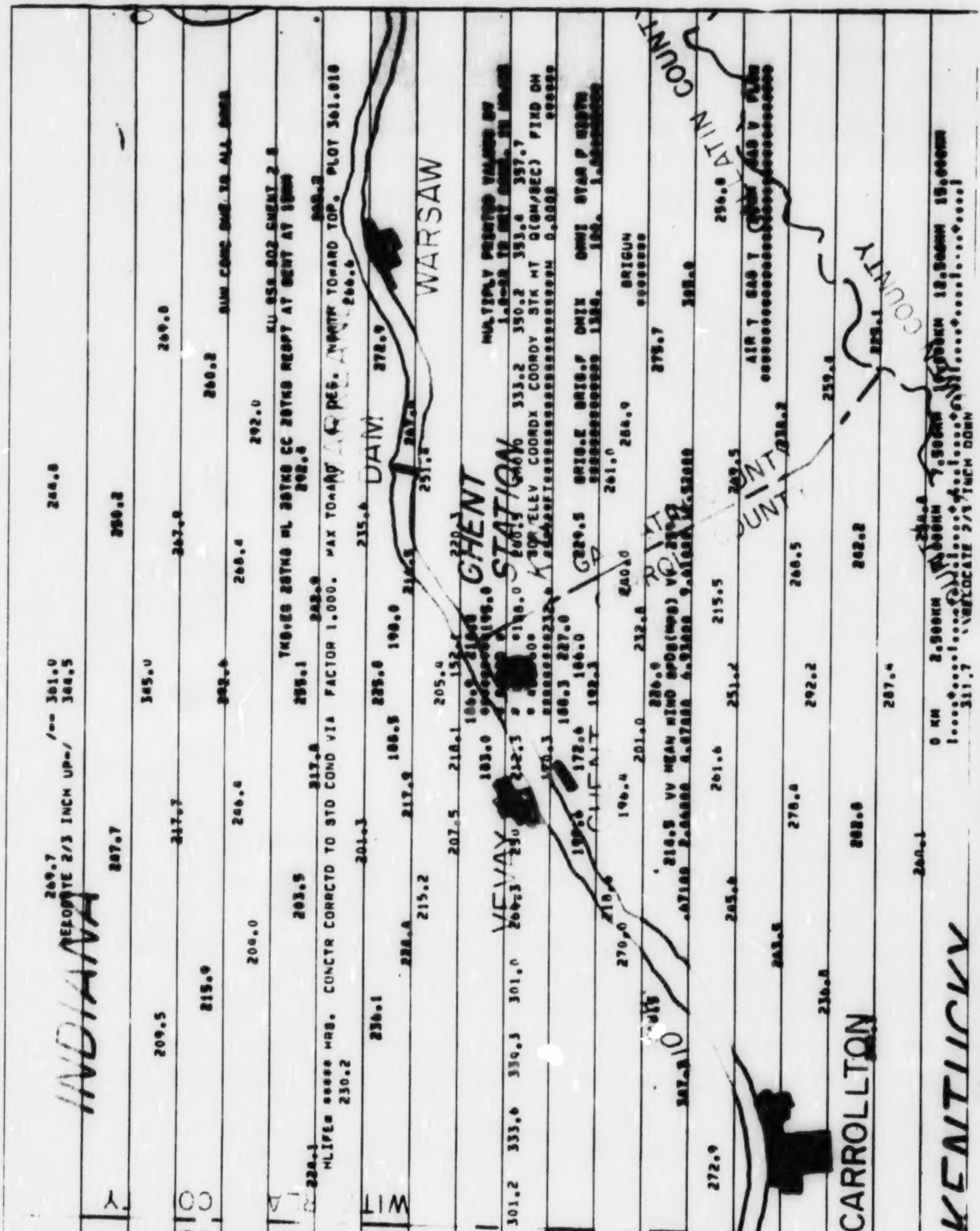

Figure 5.2-2. Annual average ambient SO_2 concentrations predicted for the Ghent area in 1983.

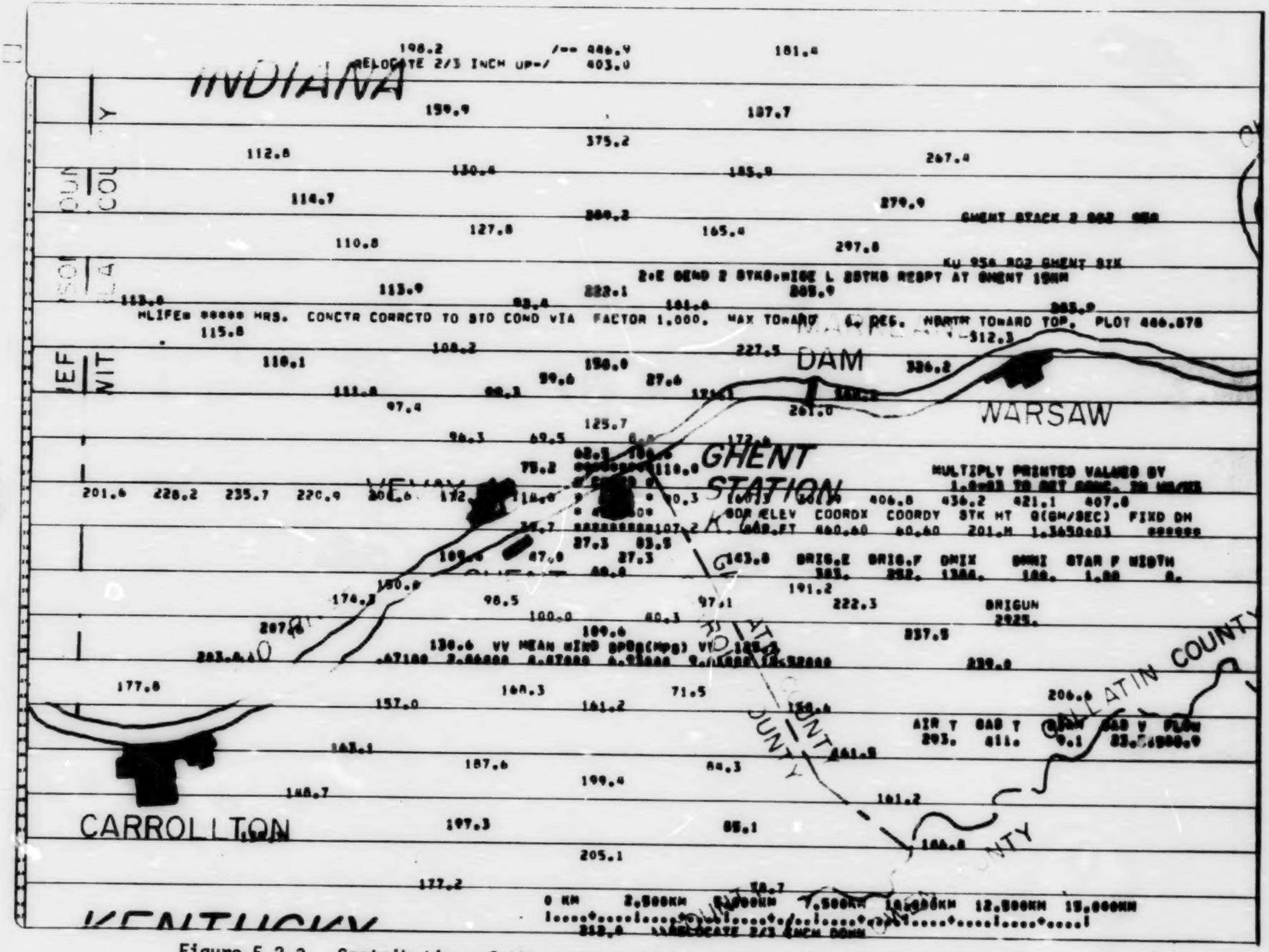
INDIANA
KENTUCKY
CARROLLTON
GHENT STATION
WARSAW
DAM
GALLATIN COUNTY
RELOCATE 2/3 INCH UP
HLIFE= 99999 HRS. CONCTR CORRCTD TO STD COND VIA FACTOR 1.000. MAX TOWARD 0 DEG. NORTH TOWARD TOP. PLOT 446.878
GHENT STACK 2 SO2
MULTIPLY PRINTED VALUES BY
SOR ELEV COORDX COORDY STK HT Q(GM/SEC) FIXD DM
ORIG.E ORIG.F DMIX DMNI STAR F WIDTH
ORIGUN
VV MEAN WIND SPDS(MPS)
AIR T GAS T GAS V FLOW
0 KM 2.500KM 5.000KM 7.500KM 10.000KM 12.500KM 15.000KM
RELOCATE 2/3 INCH DOWN

Figure 5.2-3. Contribution of the proposed Ghent units to the annual significant deterioration increment standards of SO_2 at the Ghent area.

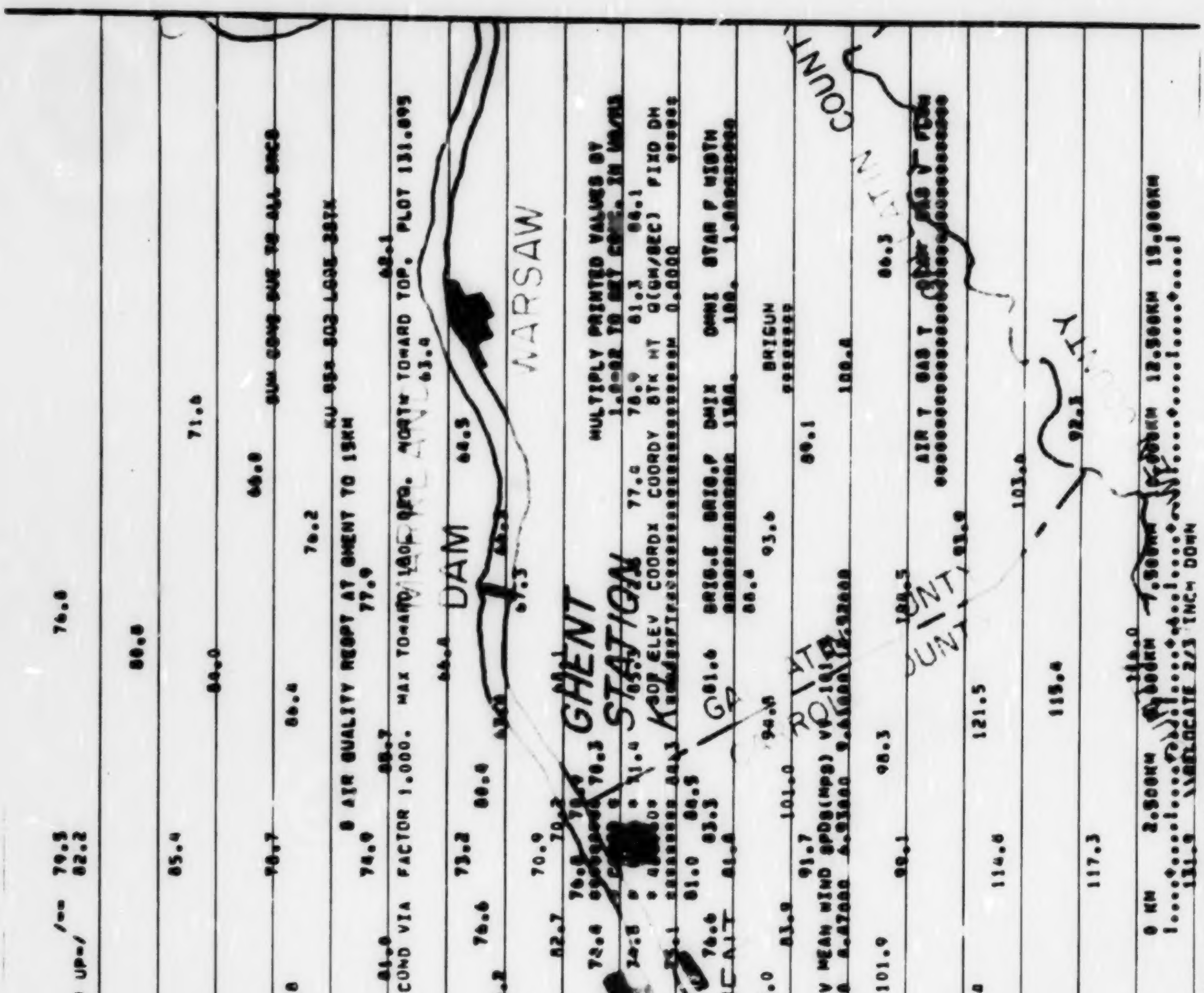

Figure 5.2-4. Contribution of the proposed Wises Landing Plant to the annual significant deterioration increment standards of SO_2 at the Ghent area.

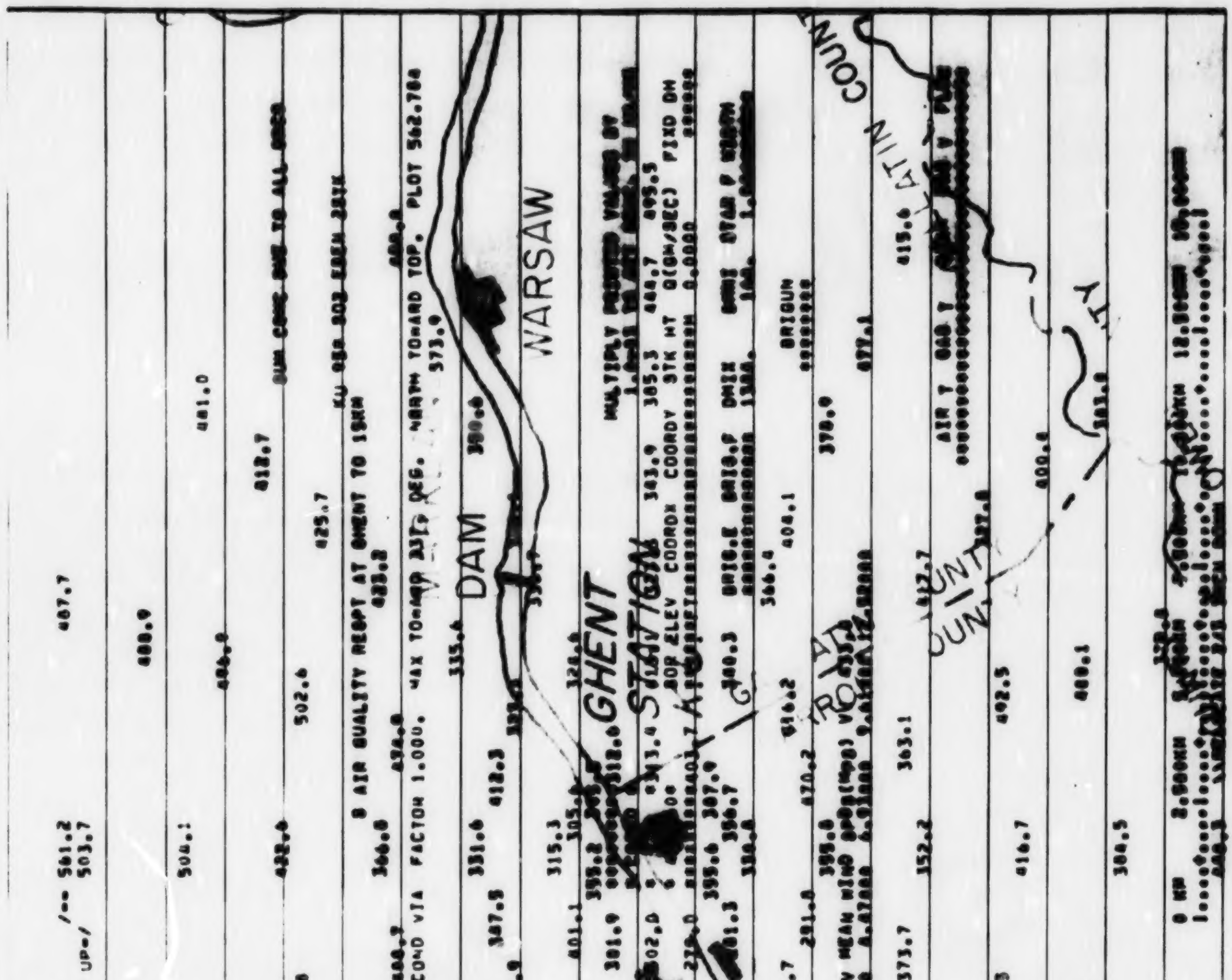

Figure 5.2-5. Contribution of the proposed East Bend Plant to the annual significant deterioration increment standards of SO_2 at the Ghent area.

Plant is predicted to be 0.9 μg/m^3 (6.2 percent of increment)* and to occur 14 km due south of the Ghent Plant. Maximum SO_2 concentration from the East Bend Plant is predicted to be 0.5 μg/m^3 (4.0 percent of increment) and to occur 14 km north-northwest of the Ghent Plant.

Figure 5.2-6 is a summation of contributions from the previously mentioned sources. The maximum annual average SO_2 concentration predicted is 1.6 μg/m^3 (10.7 percent of increment) and is predicted to occur 14 km due south of the Ghent Plant.

Ghent's proposed Units 3 and 4, Wises Landing Plant and East Bend Plant will have electrostatic precipitators installed. These electrostatic precipitators are designed to remove 99.5 percent of the fly ash produced. The percentage of the annual average TSP increment is expected to be small. The type of coal which will be used by these sources will produce an emission rate not greater than 1.2 lbs sulfur/MBTU and 0.1 lb TSP/MBTU. This will give a ratio of 1:12 TSP to SO_2.** Using this ratio, the maximum annual TSP concentration of the three previously mentioned sources operating at a 95 percent load factor is predicted to be 0.16 μg/m^3 in the Ghent area. The three sources would use 1.6 percent of the TSP significant deterioration increment standard of 10 μg/m^3.

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* The actual SO_2 concentrations that appear in Figures 5.2-4 and 5.2-6 are somewhat higher than these revised values. This is due to a reduction of the permissible emission rate of the Wises Landing Plant by a factor of 0.72 since the time of modeling. (The emission rate of 1.20 lb SO_2/MBTU was reduced to 0.86 lb SO_2/MBTU).

** Since the emission rate of the Wises Landing Plant has been reduced to 0.86 lb SO_2/MBTU, the cummulative ratio from all plants of TSP to SO_2 can be somewhat different than 1:12 depending upon the location of the predicted concentration.

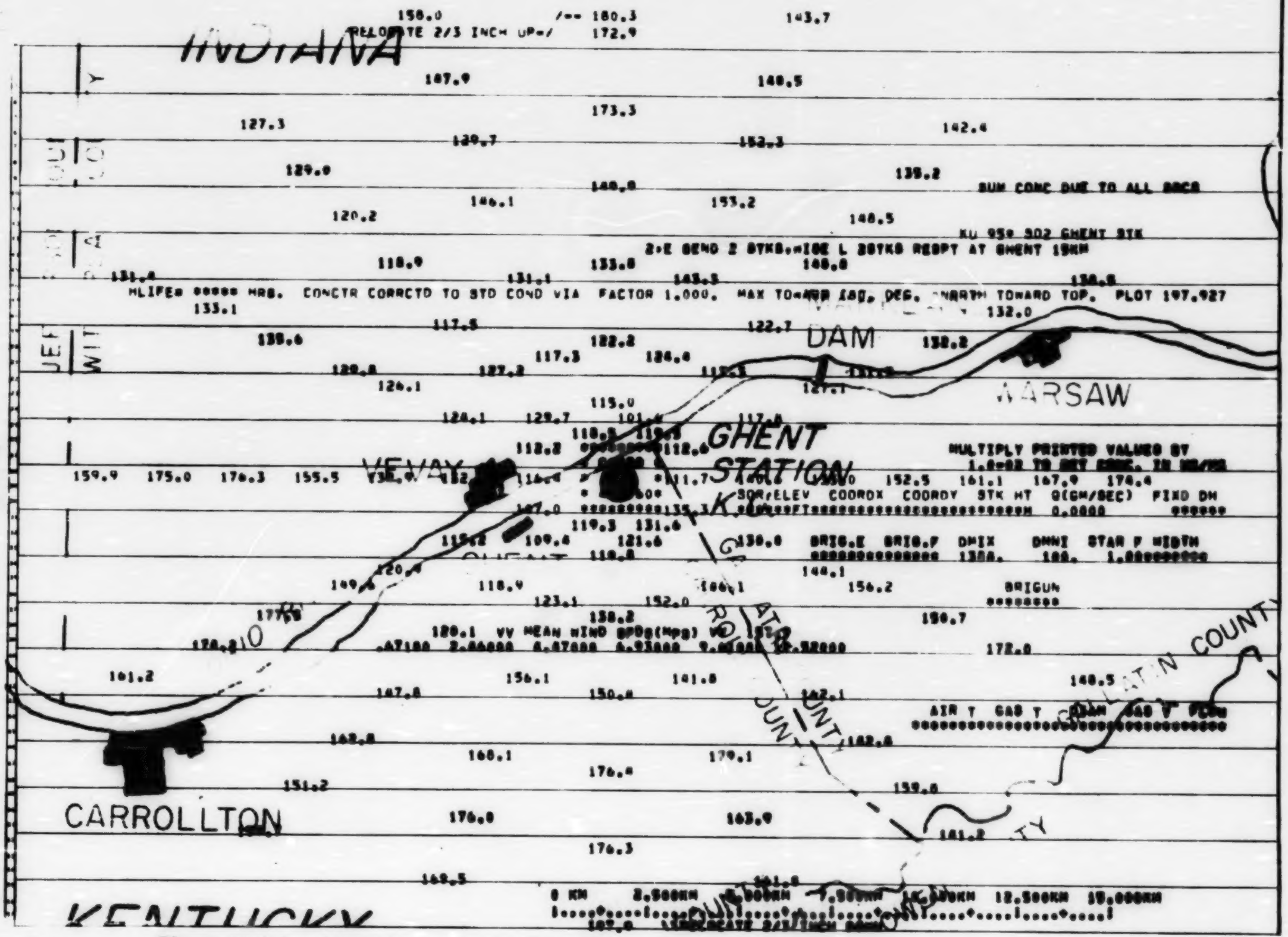
INDIANA
KENTUCKY
CARROLLTON
VEVAY
GHENT STATION
KY.
DAM
WARSAW
GALLATIN COUNTY
CARROLL COUNTY
RELOCATE 2/3 INCH UP
SUM CONC DUE TO ALL SRCS
KU 95% SO2 GHENT STK
HLIFE ***** HRS. CONCTR CORRCTD TO STD COND VIA FACTOR 1.000. MAX TOWARD DEG. NORTH TOWARD TOP. PLOT 197.927
MULTIPLY PRINTED VALUES BY 1.0E-02 TO GET CONC. IN UG/M3
SOR/ELEV COORDX COORDY STK HT Q(GM/SEC) FIXD DH
ORIG.E ORIG.F DMIX DMNI STAR P WIDTH
ORIGUN
VV MEAN WIND SPDS(MPS)
AIR T GAS T DIAM GAS V FLOW
0 KM 2.500KM 5.000KM 7.500KM 10.000KM 12.500KM 15.000KM

Figure 5.2-6. Summation of contributions to the annual significant deterioration increments of SO_2 at the Ghent area.

5.2.2.2 Effects of Plant Stack Emissions

Computed peak ground level concentrations resulting from the operation of Units 3 and 4 were presented in Section 5.2.2.1. Along with these results are included the effects of interaction between the Ghent Station and other existing and future plants in the area. These plants consist of the existing Ohio Valley Electric Cooperative's Clifty Creek Plant, the future Louisville Gas and Electric Wises Landing Plant, and the future Cincinnati Gas and Electric East Bend Plant. It is concluded that applicable national air quality standards will be met with Ghent's Units 3 and 4 in operation. Based on the fact that these standards are designed to allow no significant impact on human health, biota or public welfare, minimal effects are expected from the station's atmospheric emissions.

By operating within existing federal and state standards through the use of pollution control equipment, fuel selection and high stack dispersion, effects of plant emissions are minimized. (The 3 hr average SO_2 standard is 1300 $\mu g/m^3$.) Acute occurrences such as the 1952 London fog episode affected people of both sexes and all ages. The SO_2 concentration recorded was 4020 $\mu g/m^3$ (Machle 1969). Much higher concentrations are considered tolerable but over a period of time found detrimental to health. Possible effects of the excessive emission of particulates, SO_2 and NO_X are outlined below:

> *(1) Particulates - Adverse effects of high levels of particulate concentrations might include the following:*
>
> *Accumulation of particulates on plant surfaces may reduce light reaching the plant therby reducing photosynthesis and affecting plant growth and viability. Particulates may absorb chemicals, introduce these chemicals directly to the plant surface and cause lesions.*
>
> *Particulates may be ingested by animals eating affected plants and may be inhaled into the respiratory systems of man and other animals.*
>
> *Particulates collect on all non-living materials causing unsightliness, damage or high maintenance costs. Visible emissions are aesthetically displeasing to the residents of the area.*

Particulate emissions in many cases increase the harmful effects of other air pollutants. Particulate matter suspended in the atmosphere reduces visibility by scattering and absorbing light. Visual contract between an object and its background is reduced.

(2) Sulfur Oxides - The adverse effects of high levels of sulfur oxides, particularly sulfur dioxide, on vegetation may include the following, depending on the concentration of sulfur dioxide, the level of plant physiological activity and the species of plant:

The range of possible injuries includes suppression of growth and reduction of plant viability; chronic injury such as loss of green color due to disruption of the chlorophyll-making mechanisms, browning and drying of leaves; and acute injury such as browning, drying out, bleaching, lesions, red-brown discoloration, leaf drop, complete defoliation and death of plants.

Effects of sulfur dioxide on animals and man are also directly related to the concentration of sulfur dioxide and the combination with other air pollutants. Animals may be affected by the ingestion of affected plants or inhalation of sulfur dioxide.

Effects of sulfur dioxide on visibility and non-living material increase with increased concentration. High levels of sulfur dioxide concentrations result in the corrosion of metals, damage to electrical equipment, and discoloration and deterioration of limestone, marble, roofing slate and mortar. Atmospheric sulfur oxides may cause fading in certain textile fibers such as cotton, rayon and nylon. Leather may loose much of its strength and paper may become discolored and brittle if exposed to sulfur oxide concentrations.

(3) Nitrogen Oxides - Adverse effects of high levels of nitrogen oxide concentrations might include the following:

Increased frequency in the occurrence of respiratory diseases has been documented corresponding to increasing levels of nitrogen oxides. In the presence of nitrogen oxides, photochemical oxidation occurs. This results in the formation of photochemical smog which can have adverse effects upon the health of plants and animals (including man). Plants adversely affected by nitrogen oxides (particularly nitrogen dioxide) show lesions and reduced growth rates. Nitrate compounds have also been identified with corrosion and failure of electrical equipment. (USDA 1976)

> *(4) Interaction of Pollutants - The interaction of components of air emissions create highly variable situations. Factors such as temperature, humidity, time and the presence of catalytic metal aerosols can greatly influence reactions such as the conversion of sulfur dioxide to sulfuric acid. And while such processes may be going on, there also may be an indeterminate amount of fallout of sulfuric acid droplets and other pollutants. (Machle 1969)*

5.2.2.3 Effects of Cooling Tower Plume

Possible effects related to the plume or drift from operation of the cooling towers depends largely upon the agents, if any, used to reduce corrosion or biological fouling of the system's components. The effects also depend upon any interaction that may occur with the stack emissions (Lee and Stratton).

With the Ghent facility, the only chemical additives that will be used in the circulating cooling water will be chlorine on an intermittent basis and a small amount of sulfuric acid to adjust the pH. The drift from the cooling towers will therefore be composed of little more than Ohio River water.

Interaction of cooling tower drift with stack emissions will be minimal due to the large elevation difference between the two (630 ft).

Approximately 8,662 gpm total is expected to be lost as drift and evaporation when cooling towers for Units 3 and 4 are under full operation. This may cause fogging, icing or a visible plume under certain climatological conditions. During much of the year, fogging or icing from the cooling towers will contribute to existing fog or ice. Meteorological data from the Greater Cincinnati Airport indicates that, as a mean, on 26 days per year, visibility is limited to 1/4 mile due to heavy fog. The airport is, however, located about two miles from the Ohio River. The number of hours of naturally occurring fog will be slightly higher at the Ghent site because of its location next to the Ohio River.

No calculations were made to quantify the numbers of hours per year that the cooling tower drift will augment or increase the existing frequency of fog or icing at the Ghent Station. Theoretical calculations performed for the proposed

East Bend Station, 26 river miles upstream, indicate that fog will be increased a maximum of 33-38 hours per year. Conditions conducive to icing were not expected to occur more than 9 hours per year (USCOE 1976; East Bend Station EIS).

Similar calculations could be performed for the Ghent Station but was considered unnecessary due to the proximity of and similar climatological conditions at the two plants.

5.2.2.4 Effects of Coal Handling Facilities

High airborne dust concentrations can result from coal handling from the time of barge unloading to the time of coal combustion. Concentrations will be minimized at the Ghent Station by spraying the coal with water as it is unloaded at the coal storage areas. The drainage from the spray will be collected and routed through a settling basin and then the ash pond. Coal dust resulting from the coal being routed through the crusher house will be minimized by a fan collection system in the crusher house. The result of this procedure will be very little airborne dust and, therefore, very little environmental impact.

5.2.3 General Effects of Plant Operation

5.2.3.1 Noise

The overall increase in noise level over the existing conditions of operation of Units 1 and 2 will be slight. The area surrounding the plant property is vegetated and absorbs much of the operational noise which results principally from mechanical draft cooling tower operation. The nearest population centers, Ghent and Vevay, are approximately 2 to 3 km away and will be subjected to normal noise levels of a typical urban residential community of 58-60 dB (USEPA 1974).

5.2.3.2 Traffic

The increase in the number of employees as Units 3 and 4 become operational is expected to be about 80. This will cause a slight increase in overall traffic volume in the vicinity of the plant, especially during shift changes. Highway 42, which is the only access to the plant, should easily absorb the increased traffic load.

The rural nature of the area results in little other industrial traffic along this segment of the highway.

There is presently some problem associated with plant workers who live across the Ohio River from Ghent. The nearest crossing point is a ferry which runs between Ghent and Vevay. During shift changes, a temporary strain is placed on this crossing. However, by the time Units 3 and 4 become operational, a bridge across the Ohio River at Markland Dam will be completed and will provide a convenient crossing for Indiana residents.

5.2.3.3 Aesthetics

The aesthetic impact of any visual change in the environment will always involve a subjective judgement. In assessment of the aesthetic impact of a certain action, both the visual quality of the existing surroundings plus the visual quality of the proposed action must be compared.

The Ohio River Valley near the town of Ghent is noted for its scenic beauty. However, the Ghent Station presently has two existing units and the addition of two more units represents little change in the visual quality of the Ghent Station area. Due to vegetative cover and the hilly landscape on the southern half of the plant property, the area where the station is most visible is on the Kentucky side of the Ohio River east-northeast of the station and directly across the Ohio River. The maximum distance that the plant buildings are visible is approximately two miles. The existing stack can be seen from a much greater distance than the plant buildings since it is higher than the highest land in a 10-mile radius. The proposed stack will be identical in height and, therefore, visible for the same distance.

5.3 GENERAL ECONOMIC AND SOCIAL EFFECTS

Presently there are approximately 100 permanent jobs at the Ghent Station. As Unit 3 comes on-line the work force is expected to increase to about 120. As Units 3 and 4 become operational, the total work force associated with the operation and maintenance of the plant is expected to be about 200. This will result in 80 new jobs which will be attributable to the construction of Ghent Units 3 and 4.

Temporary jobs during the 5-7 year construction phase of Units 3 and 4 will be filled from the regional labor force. The work force will average approximately 300 with peak construction employment to be about 650.

The effect of these new jobs on the economy of Carroll County is expected to be minimal. Only about 10 percent of the construction labor force reside in the Ghent area with a majority residing in or close to nearby population centers such as Louisville, Frankfort, Cincinnati and Lexington. Workers filling the 80 new permanent jobs will probably live in the Ghent area. The effects due to these job openings will be low compared to the present employment of Carroll County (3703 in 1974) and the overall industrialization which Carroll County is undergoing (North Kentucky Area Development Division 1974).

Local residents attracted to the area as a result of the proposed project are expected to disperse widely throughout the nearby small urban and rural communities. Because of this dispersion, there will be only minor needs for additional local services in any one community. The increased county tax revenue from the enlarged Ghent Station is estimated to be at least $80,000.00 per year or 13 percent of the County budget appropriation.* School taxes account for $166,000 per year. In addition, there will be increased tax revenues from the new residents and businesses attracted by the project. In all, it is expected that local taxing districts would receive sufficient tax dollars to provide the additional governmental services for the new residents and businesses.

* Based on 1975 tax rates.

The social impact of these increases in local employment and resident population will be insignificant. There is no problem of overpopulation in the area, nor is the local economy expected to suffer from underemployment. Construction crews and base level operation and maintenance personnel have been present for about 6 years, since the construction of Unit 1 began. The construction of Units 3 and 4 will be a continuation of the construction of Units 1 and 2, and will contribute very little change in routine.

Land usage at the site will change very little since no new land will be purchased for the new units and the Kentucky Utilities' Ghent Station property is already designated as industrial.

It has been shown that the existence of a power station in an area can affect property values up to over two miles away (Blomquist 1974). The amount of this impact is difficult to assess and varies with each situation. In the case of the Ghent Station which has two generating units already in operation, the further effect on property values of a third and fourth unit can be expected to be reduced.

There will be no significant effects on recreation and sport fishing uses of the Ohio River. As explained in Section 5.2, the effect of discharges and intake structure will not affect the overall fish population in the Ohio River. Therefore, potential for sport fishing will not be hindered by the proposed project. The proposed new units will probably also not significantly affect the attendance of recreational areas. General Butler State Park is 10 km away and receives capacity attendance during the summer months and is expected to maintain this attendance record in the future.

5.3.1 The Delivered Product

The proposed Units 3 and 4 will produce one delivered product - electricity. The revenue received for this product is a measure of the tangible market benefit to be gained by the implementation of the proposed project.

The anticipated unit load schedule is presented in Table 5.3-1. This schedule is for one unit for an operating life of 35 years. From this table a total production of 79.2 million MWH over the life of the unit can be computed. A total production for both Units 3 and 4 of 158.4 million MWH can be estimated.*

Table 5.3-1

Estimated Hours Per Year of Operation
Over Life of Single Unit

Year	Load Factor					
	100%	90%	65%	45%	30%	0%
1-5	400 hr	5836 hr	1624 hr	---	---	900 hr
6-10	400 hr	4967 hr	2000 hr	493 hr	---	900 hr
11-15	400 hr	4000 hr	2232 hr	878 hr	250 hr	1000 hr
16-20	400 hr	2500 hr	1950 hr	1810 hr	800 hr	1300 hr
21-25	400 hr	800 hr	1160 hr	2400 hr	2000 hr	2000 hr
26-30	300 hr	---	800 hr	1987 hr	3173 hr	2500 hr
31-35	300 hr	---	---	967 hr	2493 hr	5000 hr

Source: Kentucky Utilities Company

Accruing of significant benefits to the public will be derived from the availability of new and dependable sources of electric power. As discussed in Section 1.2, the future demand for electric power is the rationale for the building of the new capacity. The benefits derived from the increased capacity will remain with the people of the Kentucky Utilities service area through adequate supplies of energy for their homes and livelihood.

5.3.2 Costs of Delivered Product

The costs of the delivered product from the proposed station include generation, transmission and distribution costs. The costs are the value of the resources which must be used to provide these services. These resources include the labor, material and capital as well as local environmental resources which may be affected by unit and transmission line construction and operation. Table 5.3-2 presents the breakdown of costs involved in Unit 3 and 4 construction. Table 5.3-3 presents estimated annual costs of Ghent Units 3 and 4 under a 70 percent load factor and production of 3,066,000 MWH per year.

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* Assumes hrs/yr times load factor times 500 MW/unit = total annual MWH delivered.

Table 5.3-2

Estimated Construction Costs
Ghent Units 3 and 4
1 November 1976 Price Level

	Unit 3	Unit 4
Materials	$102,441,000	$ 87,592,000
Labor	58,061,000	46,534,000
Escalation on labor and materials	45,302,000	68,615,000
Indirect Costs	12,569,000	7,024,000
Escalation on indirect costs	1,685,000	1,850,000
Allowance for funds used during construction	21,903,000	22,053,000
	$241,961,000	$233,569,000

Source: Kentucky Utilities 1976

Table 5.3-3

Estimated Annual Costs
Ghent Units 3 and 4*
1 November 1976 Price Level

Construction Costs		Annual Cost			
		Fixed Charges			
Generation	Transmission	Generation (15.5%)	Transmission (16.5%)	Fuel Cost	Total Cost
Ghent #3 - 1981					
$242,000,000	$ 499,000	$37,510,000	$ 82,335	$41,887,943	$79,480,278
Ghent #4 - 1983					
$234,000,000	$20,916,000	$36,270,000	$3,451,000	$47,065,297	$86,786,297

* The proposed units were assumed to operate at a 70 percent load factor and to produce 3,066,000 MWH per year.

Source: Kentucky Utilities 1976.

Environmental costs are not presented in this section due to the difficulty in assigning dollar values to environmental degradation. Environmental effects have been described and quantified to the extent possible in Sections 5.1 and 5.2.

5.3.3 Effects of Significant Deterioration on Industrial Growth

Significant air quality deterioration standards determine the increment increase of SO_2 and TSP concentrations allowable, for geographical areas, from sources occurring in those areas, since 1 January 1975. The Ghent Station presently falls within an area designated by USEPA as Class II with regard to significant air quality deterioration. Areas designated as Class II shall be limited to the following increases in total suspended particulates and sulfur dioxide concentrations over baseline air quality concentrations:

Class II Significant Air Quality Deterioration Increments Pollutant

Total Suspended Particulates:	ug/m^3
Annual Geometric Mean	10
24 hr Maximum	30
Sulfur Dioxide:	
Annual Arithmetic Mean	15
24 hr Maximum	100
3 hr Maximum	700

Since these increments are subtractive, a new source is permitted to use only the difference between what has already been used by new area industry and the maximum increment limit. As the increments become exhausted in each area, a restriction on the emission characteristics of potential new sources in the area is made. This can produce widespread impacts upon the development of an area in terms of industrialization and employment.

As described in Section 3.6-1, the emissions from the proposed Ghent Station Units 3 and 4 are applicable to the significant deterioration increment. Other area sources applicable to the increment are Cincinnati Gas and Electric's proposed East

Bend Station and Louisville Gas and Electric's Wises Landing Station, which are both scheduled for completion prior to the Ghent Station Units 3 and 4. (See Figure 5.3-1 for the location of these stations.)

Predictions of the percentage of each increment consumed by the three plants are based on the results of the computer modeling discussed in Section 3.6. Isopleths are plotted on base maps in Figures 5.3-2 through 5.3-4 to locate the maximum percents of the annual, 24 hr and 3 hr SO_2 increments used up in the Ghent Station area, respectively.

The maximum percentages of the SO_2 increment used for each time period are 2.9 percent (annual), 43.3 percent (24 hr) and 41.1 percent (3 hr). Isopleths for the percent of the TSP increment used are similar to the SO_2 isopleths but much lower in value and, therefore, not presented.[1,2]

The Ghent Station area presently is rural in nature with very little, if any, industry using up the significant deterioration increment. It is expected that the amount of industry will increase substantially in Carroll County over the next 20 years (Section 2.2). Limits on this growth as a result of significant deterioration laws, during this period, is remote due to the large portion of the increment remaining.

5.3.4 Effects of Barge Traffic

As stated in Section 3.4.1, the expected coal consumption for Units 3 and 4 is 2.4 million tons per year under normal load. At the present time, the planned delivery is by barge from Ashland, Kentucky. Table 5.3-4 presents the 1974 data on the commercial traffic volumes which utilize the three locks between Ashland and Ghent. Also presented is the increment of each total which is represented by coal shipments. Limited data on total commercial volumes for the period August 1975 through July 1976 at Markland Lock and Dam is also presented.

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[1] Maximum percentages of the TSP are: 1.6 percent of the annual increment and 13.2 percent of the 24 hr increment (the 3 hr increment is not applicable to TSP).

[2] Due to the reduction of the emission rate and therefore the contribution of SO_2 from the Wises Landing Plant, the percent increment values appearing here and in Figures 5.3-2, 5.3-3 and 5.3-4 are slightly lower than presented and, therefore, change the contours slightly.

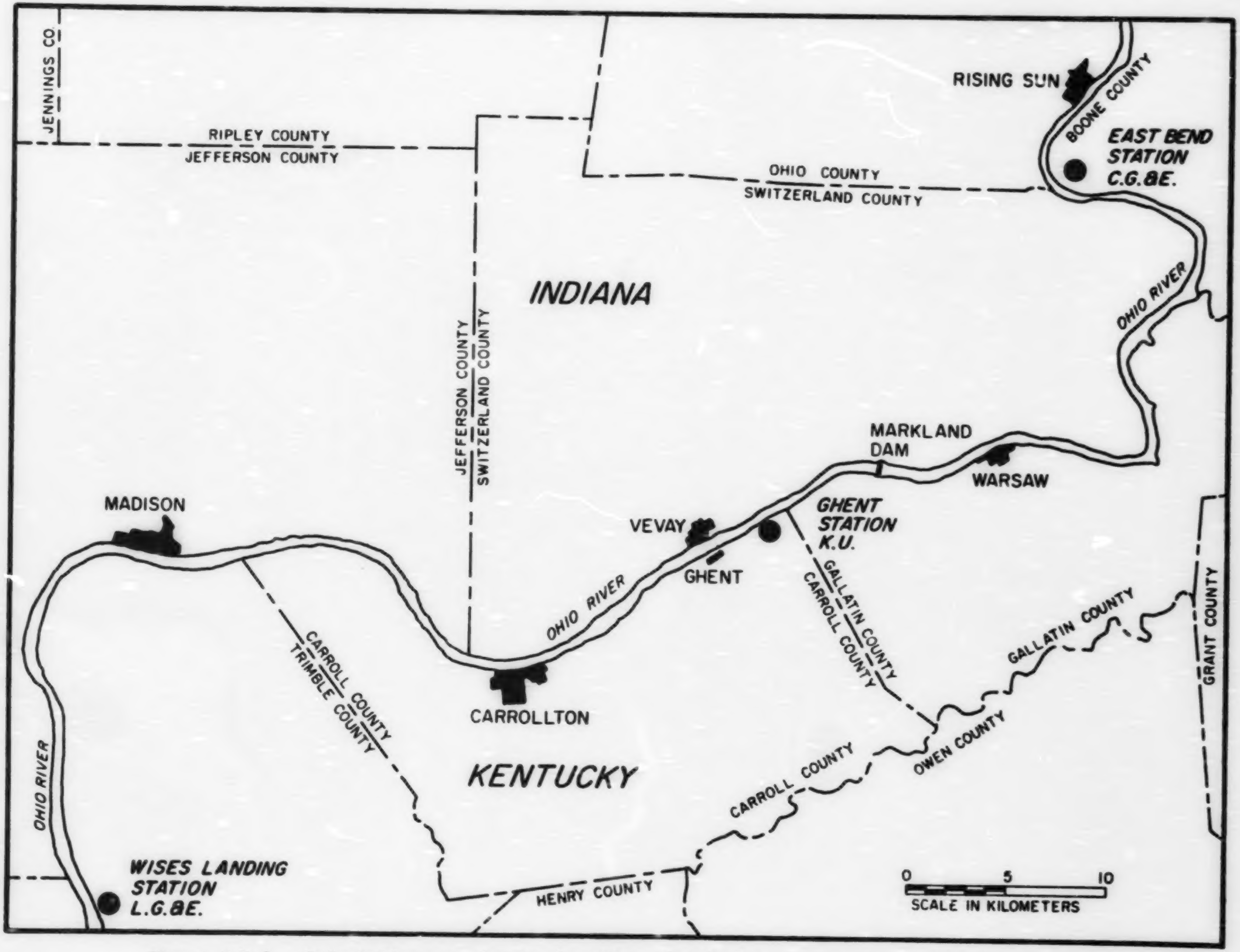


Figure 5.3-1. Orientation map showing location of emission sources in the Ghent region. (Wises Landing Station, Ghent Station and East Bend Station)

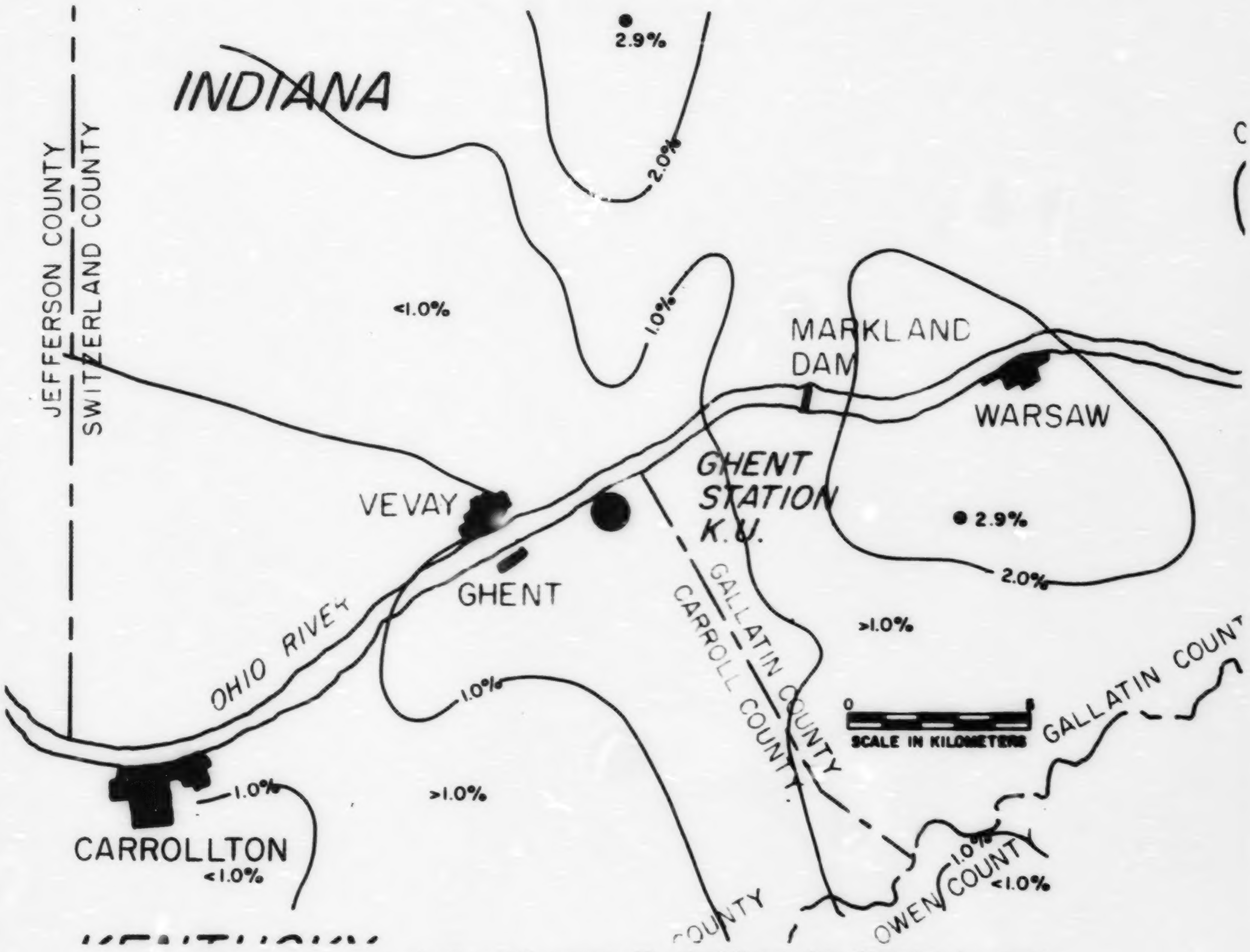


Figure 5.3-2. Percent of annual average SO_2 significant deterioration increment ($15\ \mu g/m^3$) used in the Ghent vicinity.

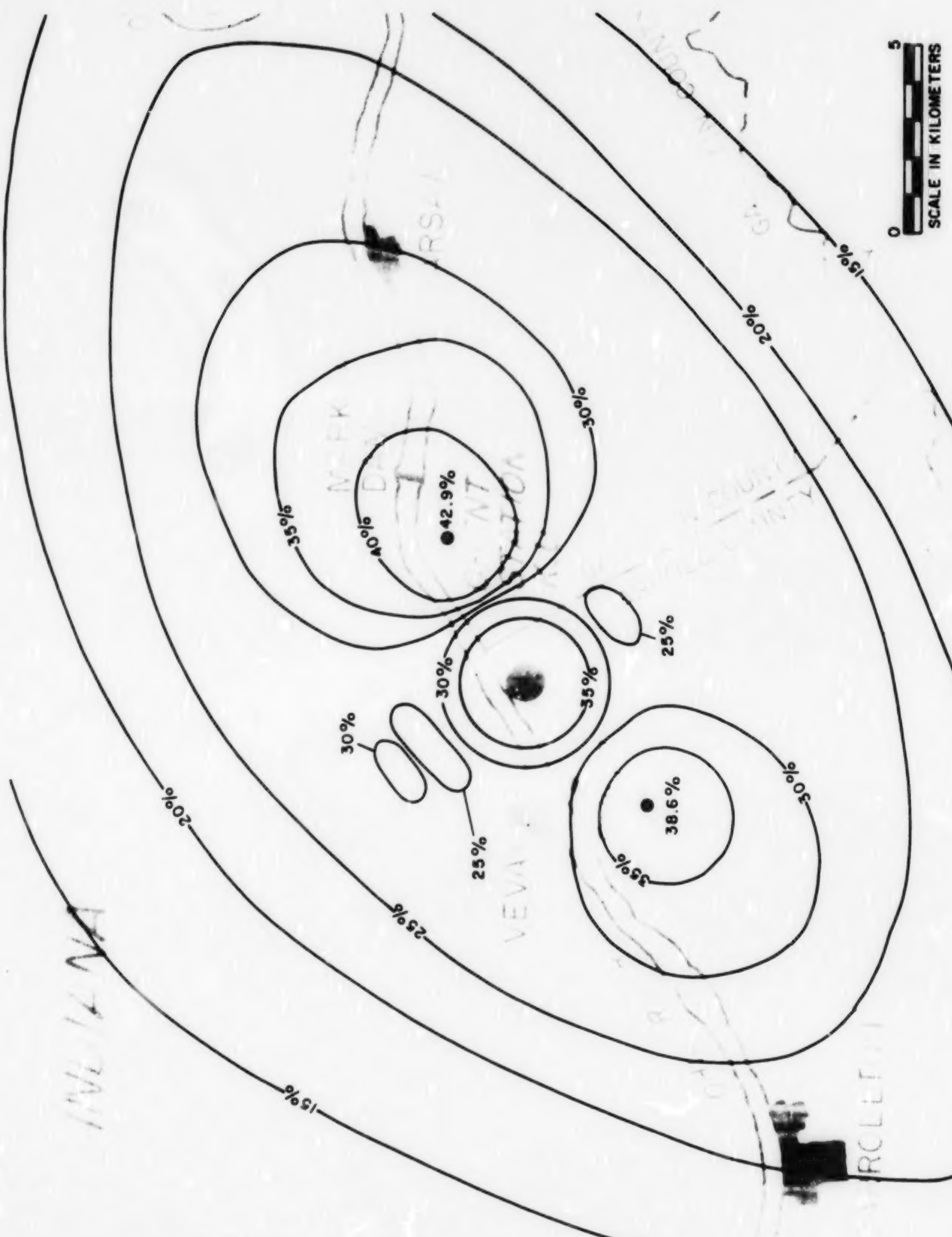
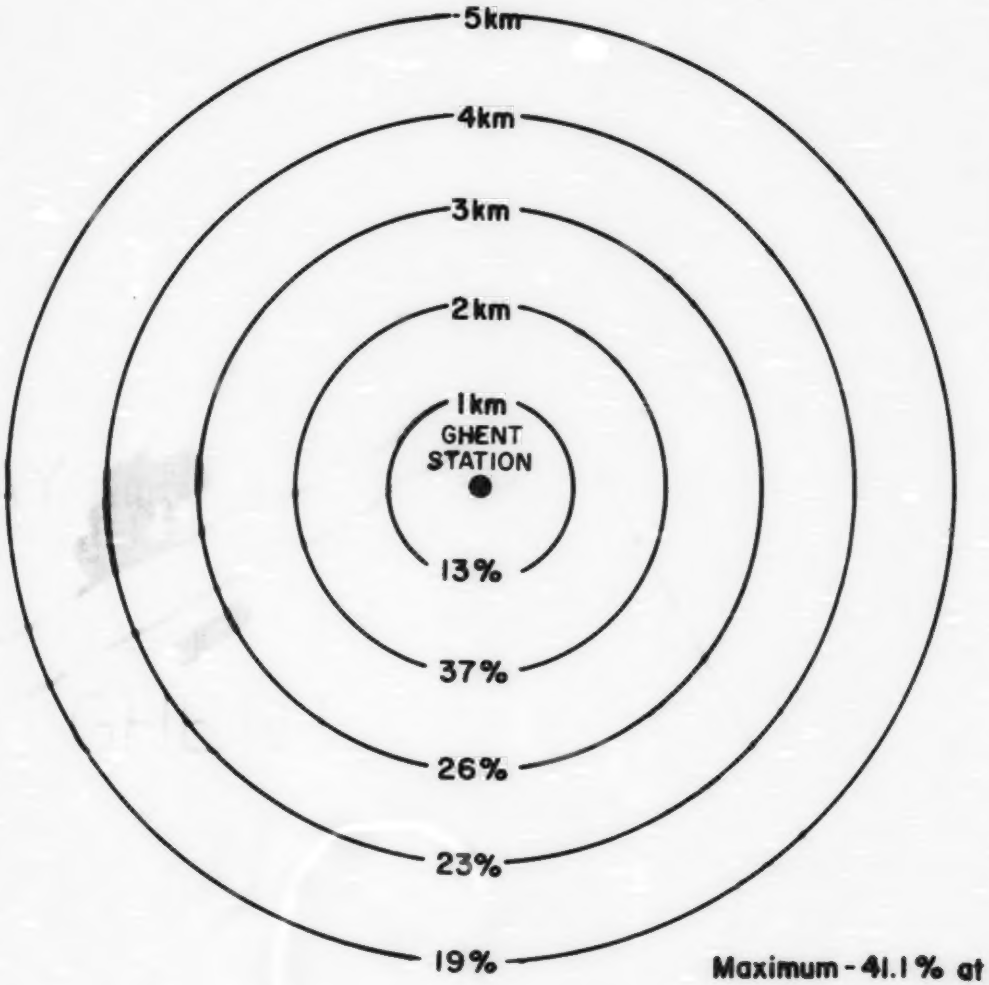


Figure 5.3-3. Percent of 24 hr average SO_2 significant deterioration increment (100 µg/m^3) used in the Ghent vicinity.



Maximum - 41.1% at 1.8 km

Figure 5.3-4. Percent of 3 hr average SO_2 significant deterioration increment (700 $\mu g/m^3$) used in the Ghent vicinity.

Table 5.3-4

Commercial Traffic on the Ohio River
between Ashland and Ghent, Kentucky*

Location	Upstream		Downstream		TOTAL	
	Coal	Total	Coal	Total	Coal	Total
Greenup Lock and Dam (1974) River mile 341.0	1.3	15.4	8.1	13.7	9.4	29.1
Meldahl Lock and Dam (1974) River mile 433.5	1.4	16.2	3.7	9.2	5.1	25.4
Markland Lock and Dam (1974) River mile 531.5 August 1975 to July 1976	N/A	21.5	N/A	10.5	N/A	32.0

Source: USCOE, Ohio River Division and Louisville District, personal communication, 1976.

* Figures expressed in millions of tons

Estimates of future commercial loads on the Ohio River are difficult to determine due to the close competition between railroads and barge companies for commercial business. It can be seen that for the period August 1975 through July 1976, the total commercial tonnage passing through Markland Lock and Dam was 32 million tons. Of this, 10.5 million tons was downstream traffic.

Ghent Units 3 and 4, when completed, will contribute 2.4 million additional tons per year on the downstream tonnage, representing an increase of 22.8 percent. Similar increases can be computed for the other locks and dams using 1974 data. The USCOE, Ohio River Division, Cincinnati, Ohio, estimates the upper capacity limit for each of the three locks and dams as 120 million tons per year (total of upstream and downstream commercial traffic). In terms of this consideration, the Ohio River will be able to assimilate the increased load resulting from the proposed project.

Recreational craft passing through Markland Lock from the period August 1975 through July 1976 numbered 2968 with the upstream traffic approximating the downstream traffic. Most of this recreational traffic occurs during May through August and represents a minor additional load to the Markland Lock.

5.4 RESOURCES COMMITTED IN PLANT OPERATION

The operation and maintenance of the proposed units will entail commitments of labor and material, including both renewable and non-renewable resources.

A major resource commitment will be that of fuel. When operating at 70 percent load factor, Units 3 and 4 will consume about 2.4 million tons of low sulfur coal per year. Approximately 2.13 million gallons of fuel will be consumed shipping the coal from East Kentucky to Ashland, Kentucky, by truck and 1.57 million gallons of fuel for shipping the coal from Ashland to the Ghent Station by barge.* These consumptive uses of fuel are termed non-renewable.

Various amounts of biocides, lubricants, paints, cleaning compounds, paving materials and chemicals will be consumed in the operation and maintenance of the station's equipment and structures.

Operation of the cooling towers for Units 3 and 4 will involve the removal of 10,624 gpm of water from the Ohio River due to evaporation and drift. Also, plant boiler and domestic water supply will remove ground water at a rate of about 302 gpm normal operation, of which 72 gpm will be steam loss. This consumption of surface and ground water can be termed a renewable resource since it will eventually be returned to the system.

The plant operation will require an addition of approximately 80 full time employees. This is a commitment of 2800 man-years of labor, assuming a 35-year plant life.

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* Assuming one-way truck distance of 48 miles at 54 ton-miles per gallon and one-way barge distance of 200 miles at 306 ton-miles per gallon (USDOT 1972 revised estimates). These estimates could change depending upon the location of the coal source and the mode of transportation.

5.5 ENVIRONMENTAL IMPACTS OF TRANSMISSION LINE CONSTRUCTION AND OPERATION

5.5.1 Natural Environment

5.5.1.1 Vegetation

No fragile or sensitive vegetation areas have been found along any of the three proposed utility corridors. However, because of the nature and scope of this study, the possibility that small areas of such a nature do exist has not been eliminated and efforts should be made to have possibly sensitive areas assessed as they may be encountered during construction and clearing operations.

A number of unavoidable changes in the vegetation will occur during the clearing and construction phases of preparing the corridors. These include:

1. The removal of many individual plant species and a reduction in the total number of native plants in the area.
2. Interference with successional stages in portions of natural communities.
3. Creation of erosion potential by the removal of ground cover species and superficial soil.
4. Promotion of increased numbers of weedy species in agriculture use areas and in the middle of natural vegetation areas.
5. Disruption of agricultural operations and loss of food production.
6. A change in the appearance of the vegetation from its pleasing state to a less attractive state.
7. Adverse effects on recreational use of the area.
8. Damage to standing timber during construction of the lines.

5.5.1.2 Wildlife

Most of the proposed lines will traverse either cropland or pastureland and will not, therefore, affect the resident or migratory birds, mammals, or reptiles in the area. The major impact on wildlife can be expected when the line further dissects those few wooded tracts left in the area (See Figure 2.3-3). Even here, the direct impact on most highly mobile wildlife will be simply one of causing them to move to adjacent wooded areas. Where an existing corridor would be widened, the impact for the additional construction would be even less.

The method of disposal of wood waste material cleared from the right-of-way could affect many small mammals in the area. If the woody waste material is windrowed along the corridor at moderate heights and intervals, small mammal populations could benefit from the increased cover available.

Resident birds and game mammals could be adversely affected by the removal of den and nesting trees, although judicious location of the line could avoid much of this impact. Section 2.4.2 has indicated several potentially fragile areas where additional care may be needed to prevent adverse impacts on wildlife.

The only two rare or endangered species whose range includes the study area are the Southern bald eagle and the Indiana myotis. Eagles have not been observed along this section of the Kentucky River, and they almost surely occur only as a rare visitant. The Indiana myotis is a cave-dwelling bat and no caves were observed in the area of the three alternate corridors.

5.5.1.3 Soils

Soils along the proposed route are not subject to excessive erosion. However, soil erosion can be expected to some degree throughout the corridor and will be confined to the following areas: tower foundation excavations, material storage yards, croplands and other sites subjected to unusual compaction or rutting of soil from vehicles.

5.5.1.4 Water Resources

Construction of the proposed transmission lines will result in a small increase in sediment loading for the various streams crossed by these lines. Since most of these streams along the route lie in cropland or pasture areas, the impact will be minimal because these drainage areas are already exposed to some anount of agricultural silt.

5.5.2 Man-Made Environment

5.5.2.1 Land Use

Forty-eight percent of the land traversed by the transmission line is open, primarily agricultural or pastureland. Cultivated areas will be available for use after construction except for that space actually occupied by the tower. In all, about 242 towers will remove about 3.422 acres from the total 703 acres (Table 5.5-1). The impact upon land use should be minimal except in wooded areas where a portion or all of the woodland habitat will be lost.

5.5.2.2 Historical

Only two sites of historical value are in the immediate preferred route vicinity. Both historical structures are listed in the Survey of Historic Sites in Kentucky and its Supplement and are located in Perry Park, Kentucky (see Figure 2.3.1.2). These sites will not be directly impacted as they lie approximately 0.4 miles from the proposed route.

5.5.2.3 Archeological

Two known archeological sites along the proposed route are located in the floodplain of the Kentucky River just south and southwest of Perry Park (see Figure 2.3.3). Archeological sites representing the Archaic, Adena (possibly Newton) and Fort Ancient cultures are extremely numerous along the valleys and on the

Table 5.5-1

Transmission Line System From The Proposed Ghent Station Unit #4

Transmission Line 345 kV single circuit	Rights-of-Way			New Transmission Towers	
	Length (miles)	Width (feet)	Area (acres)	Number	Tower Base Area (acres)
Common corridor					
a) Open	3.5	100	42.0	21	0.297
b) Forested	1.7	100	21.0	10	0.141
Long corridor					
a) Open	16.3	150	295.6	98	1.386
b) Forested	18.9	150	344.4	113	1.598
TOTAL	40.4		703.0	242	3.422

uplands along the Kentucky River, Eagle Creek, Sixmile Creek and Benson Creek. The earthen mound (Ow10) crossed by the proposed line will receive the greatest impact. A lesser impact can be expected because the preferred route also crosses the above bodies of water where little if any archeological artifacts are known but possibly exist.

5.5.2.4 Aesthetics

The transmission line and its cleared right-of-way will remain as a visual presence throughout its life. The major visual effect will be from the single-circuit, self-supporting lattice type steel towers, with a nominal tower height of 90 ft. These will be designed and constructed to minimize effects on the surrounding terrain by using selective clearing, landscape and natural screening at road crossings, creek beds and other areas adjacent to public use.

5.5.2.5 Growth and Land Values

The primary purpose in constructing this transmission line will be to provide the necessary electrical power in this area and assist in the economic growth of the area.

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6.0

ADVERSE IMPACTS AND MITIGATIVE MEASURES

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6.1 STATION ADVERSE IMPACTS AND MITIGATIVE MEASURES

6.1.1 Construction Phase

Approximately 60 acres within the existing plant site area will be disturbed by the construction of Units 3 and 4. Enlargement of the coal storage yard and construction of a drainage ditch encompassing it will remove 13.3 acres consisting mostly of second growth pastureland. This involves the total loss of vegetation cover and wildlife habitat (small mammals and birds) with migration of some of the wildlife to similar habitats adjacent to the site. The addition of the drainage ditch will minimize run-off.

Construction of the intake and discharge structures may cause a temporary eroding of a 100 ft section of the river bank. An increase in suspended solids may adversely affect the plankton and benthic communities. To minimize this, the intake structure's foundation will be built inside a cofferdam thus reducing siltation. Upon completion of the discharge structure, 650 cubic yards of riprap and 330 cubic yards of bedding will be used to help cut down the erosion process.

During construction of the main plant building, the rain water runoff will be collected in the excavation, pumped to Units 2 auxiliary sump and then pumped to the ash pond.

The permittee will minimize fugitive dust production on site by limiting clearing and grading operations to those areas essential to maintain construction sequence and schedule, grassing disturbed areas as promptly as practical and utilizing dust control measures, such as watering, as necessary on unsurfaced roadways or areas. Additionally, procedures defined in "Control of Fugitive Emissions," Kentucky State Air Regulations, Section 14, 401 KAR 3:060, will be followed.

Indications of an archaeological site discovered during a survey of the coal storage yard was found not to be of significant value. However, if additional artifacts are uncovered during the construction, the state archaeologists will be notified in order to allow them to assess the significance.

6.1.2 Operation Phase

6.1.2.1 Intake Structures

Impingement of juvenile and adult fishes can be expected, but will be minimal because of the low intake velocities. A year-long impingement study conducted by Geo-Marine, Inc. (1976) on Ghent's Units 1 and 2 (Units 3 and 4 will be similar) reported a low impingement rate concomitant with the low velocity rates (0.83 cfs).

Mortality to entrained organisms can be expected to approach 100 percent. The actual impact of the water intake to the Ohio River planktonic community will however be minimal since the intake flow for Units 3 and 4 will make up only 0.5 percent of the Ohio River historic low flows.

6.1.2.2 Waste Discharge

Before Units 3 and 4 go on-line, a preliminary monitoring of the ash pond will be conducted to determine if the acid wastes (e.g., boiler cleaning and ash hopper cleaning wastes) are being adequately treated. If federal and state standards are not met, Kentucky Utilities will build a batch treatment facility to neutralize and chemically precipitate these acid wastes before discharging into the ash pond.

A sand filtration system will be constructed in order to control with prescribed limits the suspended solids concentration of the effluent before entering the Ohio River.

6.1.2.3 Coal Handling Facilities

The anticipated increase in coal barges traffic will cause an increased load of suspended material in the Ohio River that may adversely affect the plankton and benthic community. The fish community, however, can be expected to avoid areas of increased suspended material which will reduce the potential effects on this group.

Coal dust will be minimized by wetting the coal while it is being unloaded. While in the crusher house, coal dust is collected by a fan ventilating system.

6.1.2.4 Air Pollution Devices

Electro-static precipitators are used to control emissions of total suspended particulates. In the event of a breakdown, the unit will stop operation until repairs are completed.

SO_2 emissions are expected to be within standards through the use of low sulfur coal. In the event that low sulfur coal becomes unavailable, a SO_2 scrubber device will be installed before operations are continued with high sulfur coal. Such an eventuality is unlikely since it is the intention of Kentucky Utilities to obtain a 15-year supply contract for coal with less than 0.7 percent sulfur content. Should it occur, KU will notify the State and the EPA at least three years in advance of a required shift to high sulfur coal. (See special conditions on the Draft NPDES Permit.) This will insure that all applicable emission standards are met at all times.

6.1.2.5 Cooling Towers

The interaction of cooling tower aerial blowdown (drift) with the stack emissions should be minimal because of height differences between the cooling towers (30 ft) and the stack (660 ft). Under certain climatological conditions, the potential for a visible plume, fog or ice is possible, but normally would be restricted to areas bordering the plant property and Highway 42. Meteorological data indicates that there is a mean of 26 days per year where visibility is reduced to a quarter of a mile, but this is generally limited to a few hours.

6.2 TRANSMISSION LINE ADVERSE IMPACTS AND MITIGATIVE MEASURES

6.2.1 Construction Phase

6.2.1.1 Proposed Corridor

A good deal of latitude still exists in locating the final corridor route. Additional environmental information will be included in subsequent planning work for the transmission line.

Approximately 703 acres will be substantially disturbed by clearing, grading and other construction activities. Of this total acreage, only 3.4 acres will be removed by the tower base area. Some disruption of agricultural operations can be expected with a loss in food production, but Kentucky Utilities will make amends to the property owner by payment for the lost crop according to its market price. Special care will be taken to avoid damage to off-corridor vegetation. However, some standing timber within the corridor will be damaged with a portion or all of woodland habitat lost. This route, as compared to the other two alternate routes, is the shortest, thus minimizing its impact.

Impacts on Vegetation

Some unpreventable changes in the flora will occur in laying the groundwork for the corridor. The removal of many individual plant species will cause a reduction in the total number of native plants, which will encourage an increase in numbers of weedy species, create an erosion potential and interfere with some successional stages of the natural community.

Impacts on Wildlife

The migration of wildlife to adjacent forest areas can occur when the proposed line dissects any remaining wooded tracts. By windrowing the woody waste material at moderate heights and intervals along the corridor, additional cover will be provided for these forms of wildlife which may resettle the area after construction has been terminated.

Resident birds and mammals will be adversely affected by removal of den and nesting trees, although judicious location of the proposed line around some potentially sensitive areas (see Section 2.4.2) could avoid much of this impact.

An additional vegetative/wildlife habitat survey will be performed when a finalized transmission line corridor is chosen. This will be needed to locate any rare or unsually large tree specimens and to locate any significant wildlife habitats not previously identified. This effort will be coordinated with the Commissioner, Kentucky Department of Fish and Wildlife Resources.

6.2.1.2 Mitigative Measures

Access Roads, Clearing and Waste Disposal

An absolute minimum number of new access roads will be constructed and where new roads are opened up, they will be closed after completion of the project.

Some clearing of trees and brush along the corridor is necessary. Low lying areas or ravines where operating clearances are not a problem will need no clearing. Limited clearing will be performed in other areas where maintaining the minimum clearances between the energized conductor and vegetation is necessary.

The judicious use of tailored clear cutting or selective cutting could result in a corridor with undulating boundaries which would reduce the adverse aesthetic impact by allowing for the retention of an occasional den tree, the avoidance of a wet seep, etc.

Selective clearing utilizing vegetative screens of natural low-growing forms will be left (or planted) to screen the corridor from view at all road crossings and near other areas (e.g., streams, etc.) where the appearance of the corridor would be unpleasing. For example: (1) the area near the Eagle Station Recreation area, (2) the bluffs of the Kentucky River south of Moxley, Kentucky, and (3) the wooded tract near the Twin Eagle Wildlife Management area.

Wood waste material will be disposed of by windrowing rather than burning wherever land owners will permit it. However, when burning is required, it will be performed in strict conformity with state and local regulations.

Erosion Control

Material storage yards, agricultural areas, access roads, and other sites subjected to unusual compaction of soil will be back-bladed, disked and reseeded as soon as possible following construction. Other disturbed areas (e.g., foundation excavations) will be fertilized and reseeded with grasses and small grains to minimize erosion and run-off of silt into adjacent streams. Seed mixtures will conform to the existing forage and be planted as soon as weather, soil conditions and operations permit using the cultivation method that is appropriate for that specific location. A local state agricultural extension representative will be consulted to determine the best ground cover suited to each particular terrain.

Water Precautions

Precaution will be taken to prevent the damming of any stream or the diversion of the flow of any stream. Towers will be placed at least 100 ft or more from streams to prevent erosion of the streambed. No structures will be placed in any stream or drainage channel, nor will they be put in the floodplain (e.g., Kentucky River crossing). Avoidance of stream beds (whether wet or dry) as roads poses no problem since the terrain along these streams have rock outcroppings making equipment crossings impossible. Should any creek crossings be necessary, they will be done at right angles, while any roads running adjacent to the streams will have a buffer strip between the road and creek to retard siltation or sediment loading.

Archaeological

One of the two known archaeological sites (see Figure 2.3-2) will be traversed by the preferred route. Proper rerouting of the line around this site could avert this probable impact. However, an archaeological literature investigation found that the "A-E" alternate route would probably encounter less prehistoric sites especially along the ridges east of the Kentucky River than would the preferred and the other alternate routes. This was further substantiated by the apparent numerous sites that exist along the valleys and on the uplands by the Kentucky River, Eagle Creek, Six-Mile Creek and Benson Creek; areas which are all traversed by the preferred route.

A survey will be initiated as early as route priorities have been determined on the basis of other considerations, and the survey will be confined to as limited an area as possible and adequately cover the necessary corridor. This will be done to determine if any unknown but potentially significant sites lie within the proposed construction areas.

6.2.2 Operation Phase

6.2.2.1 Radiated Electrical and Accoustical Noises

The proposed 345 kV line will utilize a twin-conductor bundle. Line hardware and the phase conductors will be designed for extra high voltage (EHV) use. To minimize corona effects, all line hardware and conductors will have a smooth clean surface, which will reduce the potential for corona discharge. In the event that radio and television interference occurs from the operation of the transmission line, Kentucky Utilities will take measures to ameliorate the problem.

Audible noise is generally of concern only during adverse weather conditions when corona effects occur. Proper design, installation and construction techniques can minimize the audible noise produced. Studies by Kolcion et al. (1973) and Perry (1971) showed that transmission lines with voltage up to 765 kV are now in operation without complaints concerning the level of audible noise.

6.2.2.2 Ground Currents and Ozone Production

The transmission line towers have a steel earth grillage foundation which helps minimize induced ground currents and distribute ground fault currents.

Since the conductor and its hardware design and the construction technique will be geared to minimizing corona formation, the associated ozone production will be small. Frydman et al. (1972) have shown through intensive studies that no measurable amounts of ozone occurred at ground level in the vicinity of transmission lines up to 765 kV.

6.2.3 Maintenance Phase

6.2.3.1 Herbicides

Controlling the regrowth and resprouting of vegetation will involve applying approved herbicides on 100 ft of the 150 ft right-of-way, giving a feathered effect to the 25 ft strip on either edge of the right-of-way. The use of the selective basal method for clearing of high-growth forms should not result in the typical "brown streak" of dead vegetation common when applying a broadcast spray. Herbicide applications will be done once every 5 years and will not be used within 50 ft of any streams.

6.2.3.2 Screening

Periodic inspection of vegetative screens will be augmented with additional or replacement plantings as needed.

6.3 ADVERTISEMENT AND ENERGY CONSERVATION

Kentucky Utilities' advertising program covers a variety of information, utilizing several media. A monthly publication enclosed with billings, "Consumer News," concentrates on providing customers with information, such as stressing the wise use of electricity; the company's efforts in supplying energy, and the necessity of building facilities as demand grows; safety items; the value of insulation; efficient appliances and electrical heating systems; and the importance and cost of pollution-control equipment. A limited number of ads are placed in newspapers within the service area. Typical ad themes include: the value of adequate insulation in homes, the value of electricity, environmental control equipment installed at power plants, the importance of building power plants for future customer needs, and how to save energy in the home. Short television spots are used, primarily stressing energy conservation and how to use electricity safely.

Kentucky Utilities also uses several other methods in providing information to its customers. News stories are released on topics such as energy use and conservation, upgrading of company facilities, construction of new transmission lines, and changes in billing procedures and forms to assist customer understanding. Information deal with the effect of the weather on electrical consumption, the use of the heat pump as an economy measure, business development and investment in Kentucky, and information on access to the company during emergency conditions. Through film presentations, efforts are made to promote better public understanding of future energy needs and wise use of electricity.

Consumer information presentations for youth and adults are held to teach the value of electricity and how to use it wisely and safely. Programs emphasize the proper selection, maintenance and safe operation of electrical appliances and comfort conditioning equipment to insure optimum operating efficiency. Assistance is given to individual customers in need of information on electrical equipment and thermal insulation. Slide and film programs are also presented on such topics as energy conservation, sources of energy, and the demand for electricity.

Clinics are conducted for customers planning to build or remodel homes, with special emphasis on efficient energy utilization. Meetings are held to acquaint builders with new features and techniques available for energy efficient homes and apartments.

Appliance dealer meetings are held to keep the dealers informed on developments in the utility and electric appliance industries which concern them and affect their business and communities. Meetings are designed to help the dealers effectively communicate with their customers in the use of new equipment.

A bimonthly publication, "Dealer News," is mailed to appliance dealers informing them on the availability and importance of energy efficient appliances. Information and ideas are exchanged on merchandising, advertising practices, new stores, employees and merchandise lines with dealers throughout the service area.

As shown in Section 1.2, the rise in consumption is primarily due to a larger reliance on electricity for home and industrial heating and air conditioning in new construction. Further gains in reducing the wasteful use of electricity through increased conservation methods are thereby not adequate to entirely offset the demand for electricity and therefore the need for creation of new generating capacity. These gains, however, through advertisement and energy conservation, will in the long run tend to reduce the annual growth in demand from pre-1973 rates.

6.4 MONITORING PROGRAMS

6.4.1 Stack Emission Monitoring Programs

To insure that the Ghent Units 3 and 4 are in compliance with state and federal ambient air quality standards, equipment will be installed to monitor stack emissions (i.e., suflur dioxide and particulates). In accordance with state regulations, this air monitoring and equipment will be available for inspection by state personnel at their convenience without notice to Kentucky Utilities.

6.4.2 Water Monitoring Programs

As Unit 3 becomes operational, there will be a total of three waste streams entering the Ohio River. One is the ash pond discharge and the other two are once-through cooling discharges from plant heat exchangers of Units 1 and 2 and Units 3 and 4, respectively. To insure that water quality standards are met, monitoring of each discharge will be performed on a regular basis as outlined in the Draft NPDES permit. In addition, the Draft NPDES permit requires monitoring to be performed at several other points in the plant water use cycle. Each monitoring point with respective discharge serial number, limitation and monitoring regime is outlined in the Draft NPDES permit, Section 8.0.

Monitoring of the groundwater, down gradient of the ash and coal storage areas, will be performed to detect potential escape of leachate from these two areas. Quarterly reports will be sent to EPA, Region IV and the Commonwealth of Kentucky.

6.5 DRAFT STIPULATION

EPA, Region IV has formally proposed several mitigative measures in a draft stipulation between the Applicant and EPA. The draft stipulation is prerequisite to a favorable recommendation in the Final EIS for issuance of the NPDES Permit. It will be modified as needed following the public commenting period and then executed by both parties prior to the Final EIS.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET, NE
ATLANTA, GEORGIA 30308

DRAFT

IN THE MATTER OF

NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM
APPLICATION NO. KY0002038
KENTUCKY UTILITIES
GHENT POWER PLANT UNITS 3 AND 4

Applicant

STIPULATION FOR THE
APPROVAL OF THE
REGIONAL ADMINISTRATOR

PRELIMINARY STATEMENT

The Kentucky Utilities Company, (the "Applicant") has applied for a National Pollutant Discharge Elimination System (NPDES) permit from the Environmental Protection Agency (EPA) to discharge pollutants from Ghent Units 3 and 4. The application has been identified as NPDES No. KY0002038. On November 5, 1975, the EPA Regional Administrator made the determination that construction of Ghent Units 3 and 4 was construction of a new source within the purview of Section 511 of the Federal Water Pollution Control Act (the Act) and thereby would require an environmental review pursuant to the National Environmental Policy Act of 1969 (NEPA), prior to issuance of the permit. On January 15, 1976, EPA decided that an Environmental Impact Statement (EIS) would be necessary for this project.

The EIS identified potentially unacceptable environmental impacts in the form of future contingencies. The stipulations set forth below were developed pursuant to EPA's authority and responsibility under the Act and under NEPA. It is understood by both parties that this stipulation has been entered into for the purposes of preventing or minimizing potentially adverse environmental impacts identified in the EIS and for the purposes of obtaining EPA's recommendation to issue the permit.

STIPULATION

The Applicant and the Regional Administrator, Environmental Protection Agency, Region IV, stipulate and agree as follows:

1. Prior to construction of a desulfurization system which would transport solid wastes or materials off-site, the site as described in the EIS, the Applicant shall submit to the Regional Administrator for an environmental review and approval, an adequate Environmental Impact Assessment. Upon notification of the intent to construct such a system, EPA shall determine the proper scope of the Environmental Impact Assessment and shall specify what information is required in the Environmental Impact Assessment to complete requirements for this environmental review. The applicant agrees not to initiate construction on the desulfurization system or the associated waste disposal system prior to completion of the environmental review and approval from the Regional Administrator of the EPA.

2. Prior to the selection of the proposed final alignment of the Ghent to Frankfort transmission corridor, the Applicant shall submit to the Regional Administrator for review and approval the following:

   a. A plan of study (POS) for determining archaeological resources along the transmission corridor, and

   b. A POS for a ground level vegetative wildlife habitat survey along the transmission corridor.

   The Regional Administrator shall approve or modify each POS following consultation with the State Archaeologist or Commissioner, Kentucky Department of Fish and Wildlife Resources, respectively. The Applicant shall perform the studies as approved and supply a report on the results of the studies to the Regional Administrator for completion of EPA's environmental review on this portion of the project. The applicant agrees not to initiate construction on this transmission line prior to completion of the environmental review and receipt of approval from the Regional Administrator of the EPA.

3. In the event the Applicant proposes final alignment of any additional transmission corridors required for successful operation of the new source facilities, the Applicant shall submit, and after review and approval by the Regional Administrator, perform the plan of studies described in "2" above for any such transmission corridors. The applicant agrees not to initiate construction on these transmission lines prior to completion of the environmental review and receipt of approval from the Regional Administrator of the EPA.

4. The Applicant waives its right to request an adjudicatory hearing, pursuant to 40 CFR 125.36(b), within 10 days on any item agreed to herein.

5. Nothing in this Stipulation shall be deemed to relieve the Applicant from liability for non-compliance with other provisions of the Federal Water Pollution Control Act, as amended, or any other Federal laws, including any requirements of the Resource Conservation and Recovery Act of 1976, which might be made applicable to this facility.

6. The terms contained herein shall not bind any person not a party to the Stipulation and shall not bind the Applicant or the U.S. Environmental Protection Agency until signed by the Applicant and the Regional Administrator, Region IV.

Date

Applicant

By:

Date

Director, Enforcement Division
U. S. Environmental Protection Agency
Region IV

Date

Acting Regional Administrator
U. S. Environmental Protection Agency
Region IV

6.6 MITIGATION PLAN SUBMITTED TO EPA

A plan to monitor and control groundwater contamination and a plan to control erosion and sedimentation at the Ghent Station have been proposed to EPA Region IV by the Applicant. Following public comment and before the Final EIS is issued, these plans will be modified if necessary and then approved by EPA. The permit conditions in Part 2 of the Draft NPDES Permit (Section 8.0) refer to these plans.

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KENTUCKY UTILITIES COMPANY

GHENT STATION

PROPOSED PLAN TO MONITOR THE GROUNDWATER

SUBMITTED TO EPA

BY

KENTUCKY UTILITIES

Kentucky Utilities Company Ghent Station

Proposed Plan to Monitor the groundwater downgradient of the ash pond and coal storage areas.

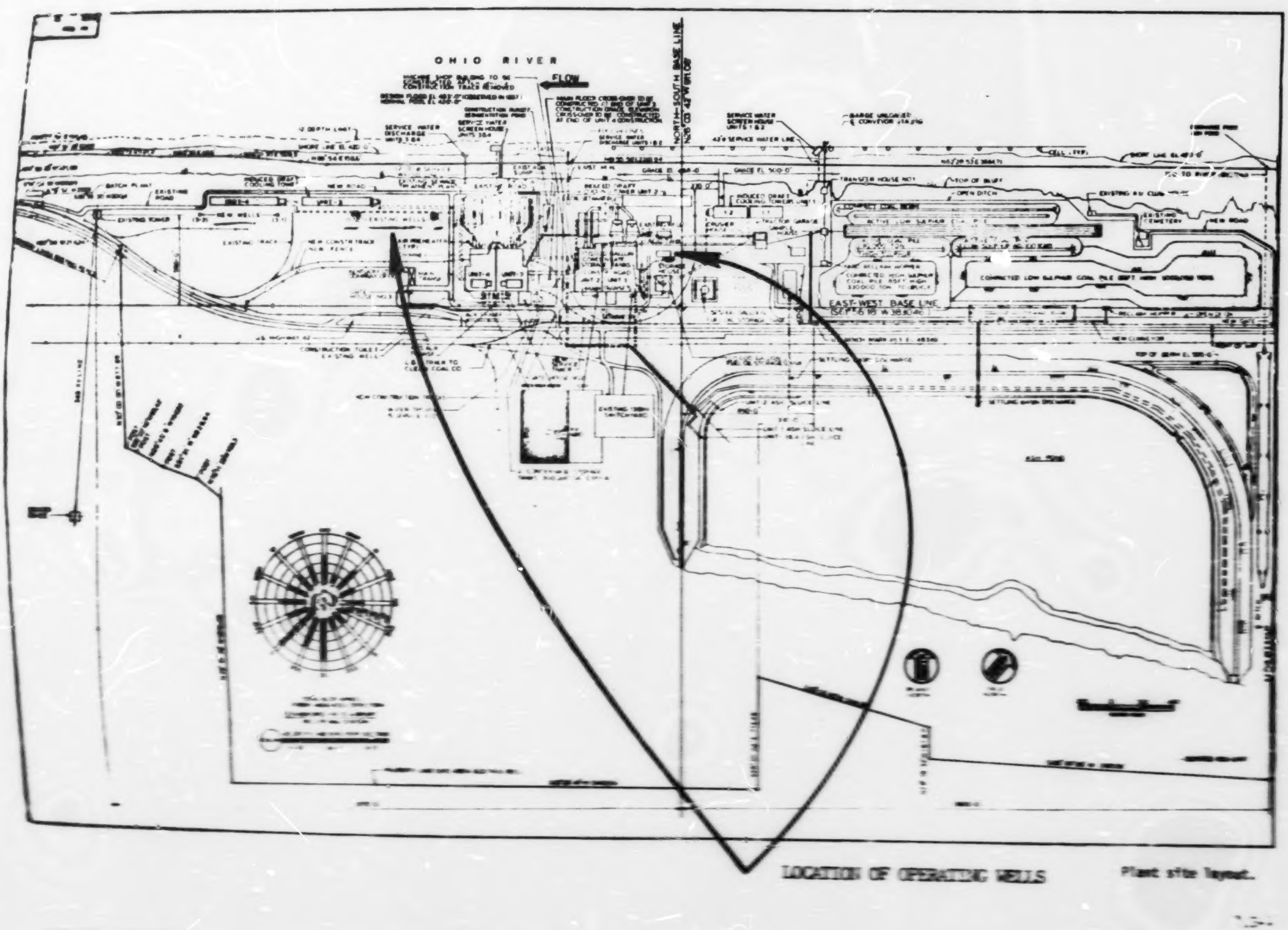
Applicable EPA approved methods of analysis shall be used to detect and determine the quantity of the following in the groundwater: copper, iron, lead, mercury, nickel, selenium, chloride total suspended solids and total dissolved solids.

We propose to monitor our present wells and the future wells which will be drilled for units 3 and 4. Testing will be on a monthly basis with quarterly reports to EPA and Kentucky Dept. for Natural Resources and Environmental Protection Division of Water Quality.

Should the quarterly reports demonstrate any significant increase in contamination of the groundwater we plan to implement measures to control this contamination.

Measures acceptable to EPA to control the contamination may include but not be limited to: sealing, relocating or altering operations of the ash pond, coal storage areas and sludge disposal areas as required.

A plat of the plant site indicating the location of the present and future wells in relation to the ash pond and coal storage areas is attached. Wells 1-1, 1-2, and 2-1 are each 125 feet deep and are operating. The capacity of the 1-1 and 1-2 wells are 200 gallons per minute. The capacity of the 2-1 well is 400 gallons per minute.



LOCATION OF OPERATING WELLS

Plant site layout.

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KENTUCKY UTILITIES COMPANY

GHENT STATION

PROPOSED CONSTRUCTION EROSION AND SEDIMENT CONTROL PLAN

SUBMITTED TO EPA

BY

KENTUCKY UTILITIES

KENTUCKY UTILITIES COMPANY GHENT STATION

PROPOSED CONSTRUCTION EROSION AND SEDIMENT CONTROL PLAN

The plant area bounded by the perimeter plant road is the area where major construction activities for Units 3 & 4 will be concentrated for a period of more than one year. The earthwork in this area will consist of excavation for building foundations, backfilling and grading work. The excavated materials will be deposited in a designated stockpile and spoil area adjacent to the existing ash pond. (See SK-770729). Storm runoff in the excavated area will be pumped into the existing auxiliary sump and will be discharged into the ash pond. After backfilling of the plant building excavation, final grading of the plant area will be done to drain the area into the storm drain system that will discharge into the Ohio River. Seeded top soil will be provided on the graded area around the building to prevent erosion.

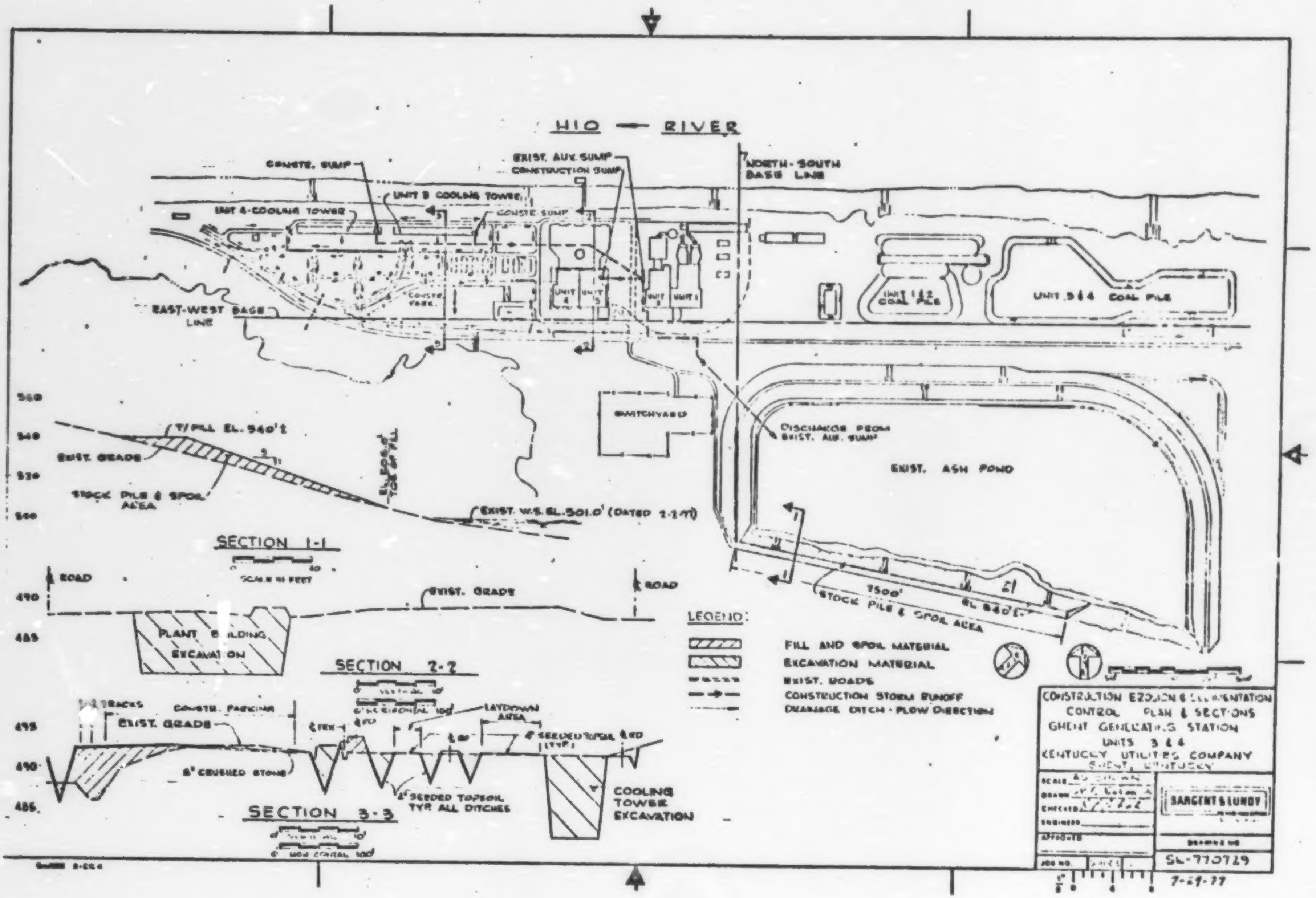
Grading and drainage work for the laydown area and construction parking area, and excavation and backfilling for the foundations of cooling towers are the other construction activities which will involve earthwork. These construction activities are expected to be completed within a three to four month period.

Excess cut materials in these areas will be deposited in the spoil area near the ash pond. Storm runoff in the cooling tower excavation will be pumped into the existing auxiliary sump and will be discharged into the ash pond.

The construction parking area will be provided with 8 inch crushed stone layer which will prevent erosion in this area. Drainage ditches and graded surface in the laydown area will be provided with seeded top soil to prevent erosion.

The drainage system in the laydown area and construction parking area will consist of ditches and culverts. The system will follow the existing drainage pattern for the area which discharges into the Black Rock Creek leading into the Ohio River.

All rainwater in excavations for piping installation will be pumped to the auxiliary sump. Excavated materials will be stockpiled adjacent to the excavations so that runoff is back into the excavation. Excess excavated material will be hauled and stored on the south side of the ash pond. As each trench is backfilled it will be leveled off and seeded immediately. Straw will be applied to prevent any backfill materials from being washed into the drainage ditches.


HIO — RIVER
CONSTR. SUMP
UNIT 4-COOLING TOWER
UNIT 3 COOLING TOWER
CONSTR. SUMP
EXIST. AUX. SUMP
CONSTRUCTION SUMP
NORTH-SOUTH BASE LINE
EAST-WEST BASE LINE
CONSTR. PARK.
UNIT 4
UNIT 3
UNIT 2
UNIT 1
UNIT 1 & 2 COAL PILE
UNIT 3 & 4 COAL PILE
SWITCHYARD
DISCHARGE FROM EXIST. AUX. SUMP
EXIST. ASH POND
7500'
EL 540'±
STOCK PILE & SPOIL AREA
560
540
520
500
T/FILL EL. 540'±
EXIST. GRADE
STOCK PILE & SPOIL AREA
EL. 520.0' TOP OF FILL
EXIST. W.S. EL. 501.0' (DATED 2-1-77)
SECTION 1-1
0
40
SCALE IN FEET
℄ ROAD
490
485
EXIST. GRADE
PLANT BUILDING EXCAVATION
℄ ROAD
SECTION 2-2
0' VERTICAL 10'
0' HORIZONTAL 100'
TRACKS
CONSTR. PARKING
495
490
485
EXIST. GRADE
8" CRUSHED STONE
℄ RD
LAYDOWN AREA
4" SEEDED TOPSOIL (TYP.)
℄ RD
4" SEEDED TOPSOIL TYP. ALL DITCHES
COOLING TOWER EXCAVATION
SECTION 3-3
0' VERTICAL 10'
0' HORIZONTAL 100'
LEGEND:
FILL AND SPOIL MATERIAL
EXCAVATION MATERIAL
EXIST. ROADS
CONSTRUCTION STORM RUNOFF
DRAINAGE DITCH - FLOW DIRECTION
CONSTRUCTION EROSION & SEDIMENTATION CONTROL PLAN & SECTIONS
GHENT GENERATING STATION
UNITS 3 & 4
KENTUCKY UTILITIES COMPANY
GHENT, KENTUCKY
SCALE AS SHOWN
DRAWN
CHECKED
ENGINEER
APPROVED
JOB NO.
SARGENT & LUNDY
DRAWING NO.
SL-770729
7-29-77

6.7 REFERENCES

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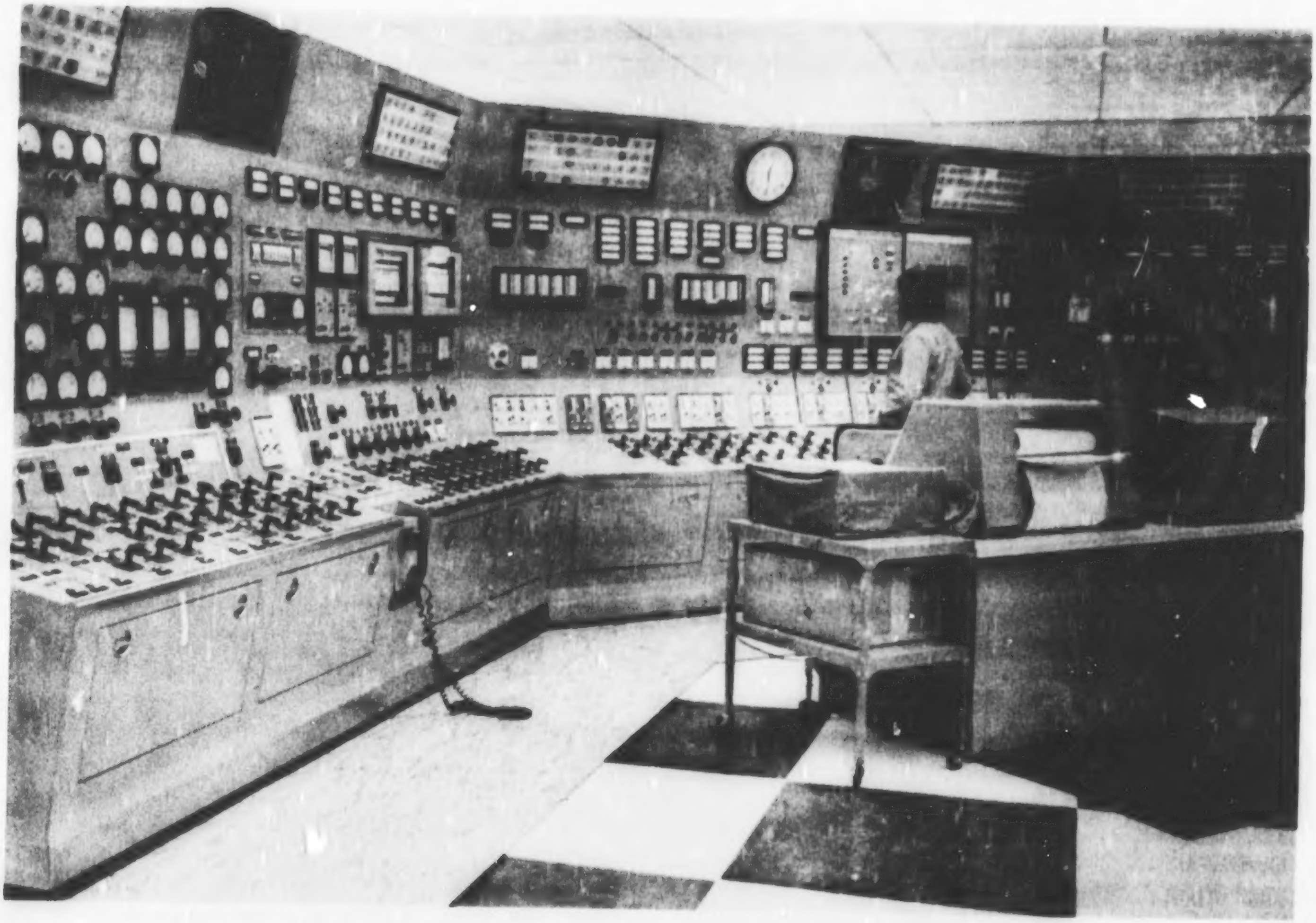
SECTION 7.0

COMMENTS FROM FEDERAL AND STATE AGENCIES AND THE PUBLIC



SECTION 8.0

DRAFT PROPOSED PERMITS

Permit No. KY0002038

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

Kentucky Utilities Company
120 South Limestone Street
Lexington, Kentucky 40507

is authorized to discharge from a facility located at

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Ghent Generating Station
Units 1 - 4
P. O. Box 338
Ghent, Kentucky 41045

to receiving waters named Ohio River
from discharge points enumerated herein as serial numbers 001, 002, 003, 004, 005, 006, 007, 008, and 009

during the effective period of this permit

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit is a modification of the NPDES permit issued for this facility on February 17, 1976, and replaces that permit in its entirety. This modified permit shall become effective 30 days after receipt.

This modified permit and the authorization to discharge shall expire at midnight, April 3, 1981. Permittee shall not discharge after the above date of expiration without prior authorization. In order to receive authorization to discharge beyond the above date of expiration, the permittee shall submit such information, forms, and fees as are required by the Agency authorized to issue NPDES permits no later than 180 days prior to the above date of expiration.

Signed this day of

Director, Enforcement Division

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through start of discharge from Unit 3 the permittee is authorized to discharge from outfall(s) serial number(s) 001 - Ash pond discharge to the Ohio River (Units 1 and 2)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Temperature °C(°F)	N/A	33.9(93) 1/	Continuous	Recorder
Flow–m³/Day (MGD)	N/A	N/A	Continuous	Recorder
Oil and Grease (mg/l)	15	20	1/week	Grab
Total Suspended Solids (mg/l)	30	50	1/week	Grab
Heavy Metals	See Below		1/month	Grab
* Total Chlorine Residual (mg/l)	Not Detectable		2/month	Grab

Monitoring for heavy metals shall include total arsenic, cadmium, chromium, copper, iron, lead mercury, nickel, selenium, and zinc.

* Limitations and monitoring requirements are not applicable unless chlorine use is instituted.

1/ The receiving water shall not exceed (1) a maximum water temperature change of 2.8°C(5.0°F) relative to an upstream control point, and (2) maximum temperatures noted below outside of a mixing zone which shall not exceed (1) a maximum width of 125 feet nor (2) a 200-foot linear downstream length.

Jan 10°C (50°F)	April 21 (70)	July 32 (89)	Oct 26 (78)
Feb 10 (50)	May 27 (80)	Aug 32 (89)	Nov 21 (70)
Mar 16 (60)	June 31 (87)	Sept 31 (87)	Dec 14 (57)

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): discharge from ash pond prior to mixing with any other waste stream.

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/ and lasting through 2/
the permittee is authorized to discharge from outfall(s) serial number(s) 001 - Ash Pond Discharge to the Ohio River (Units 1-3)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	N/A	N/A	N/A	N/A		
Temperature °C(°F)	N/A	N/A	N/A	33.9(93) 4/	Continuous	Recorder
Total Suspended Solids	720(1590)	2390(5280)	20	50	Continuous	Recorder
Oil and Grease	360(800)	720(1580)	10	15	1/week	Composite
					1/week	Grab
Total Chlorine Residual 3/	Not Detectable		Not Detectable		2/month	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):
Discharge from the ash pond filter effluent.

1/ Start of discharge from Unit 3
2/ Start of discharge from Unit 4
3/ Limitations and monitoring requirements are not applicable unless chlorine use is instituted.
4/ The receiving water shall not exceed (1) a maximum water temperature change of 2.8°C(5.0°F) relative to an upstream control point and (2) maximum temperatures noted below outside of a mixing zone which shall not exceed (1) a maximum width of 125 feet nor (2) a 200-foot linear downstream length.

Jan	10°C (50°F)	April	21 (70)	July	32 (89)	Oct	26 (78)
Feb	10 (50)	May	27 (80)	Aug	32 (89)	Nov	21 (70)
Mar	16 (60)	June	31 (87)	Sept	31 (87)	Dec	14 (57)

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/ and lasting through 2/
the permittee is authorized to discharge from outfall(s) serial number(s) 001 - Ash Pond Discharge to the Ohio River (Units 1-4)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	N/A	N/A	Continuous	Recorder
Temperature °C(°F)	N/A	N/A	N/A	33.9(93) 4/	Continuous	Recorder
Total Suspended Solids	870(1920)	2840(6270)	20	50	1/week	Composite
Oil and Grease	440(960)	850(1880)	10	15	1/week	Grab
Total Chlorine Residual 3/	Not Detectable		Not Detectable		2/month	Grab

Monitoring for heavy metals shall include total and soluble arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium and zinc.

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):
Discharge from the ash pond filter effluent.

1/ Start of discharge from Unit 4
2/ Expiration
3/ Limitations and monitoring requirements are not applicable unless chlorine use is instituted.
4/ The receiving water shall not exceed (1) a maximum water temperature of 2.8°C(5.0°F) relative to an upstream control point, and (2) maximum temperatures noted below outside of a mixing zone which shall not exceed (1) a maximum width of 125 feet nor (2) a 200-foot linear downstream length.

Jan	10°C	(50°F)	April	21	(70)	July	32	(89)	Oct	26	(78)
Feb	10	(50)	May	27	(80)	Aug	32	(89)	Nov	21	(70)
Mar	16	(60)	June	31	(87)	Sept	31	(87)	Dec	14	(57)

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 002 - **Once-through cooling water** from miscellaneous plant heat exchangers and yard drainage to the Ohio River (Units 1 and 2)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Chlorination Period Average	Instantaneous Maximum	Measurement Frequency	Sample Type
Flow-m /Day (MGD)	N/A	N/A	1/week	Weir reading or staff gauge
Discharge Temperature °C(°F)	1/	1/	1/week	Grab
Total Chlorine Residual	See Below		1/week	Multiple grabs

Yard drainage may be discharged without limitation or monitoring requirements.

Total residual chlorine shall not exceed a maximum instantaneous concentration of 0.3 mg/1 nor an average of 0.2 mg/1 for a maximum period of one hour per day. In the event that the system(s) cannot be operated at or below this level of chlorination, the applicant may submit a demonstration, based on biological toxicity data, that discharge of higher levels of chlorine are consistant with toxicity requirements of the Kentucky Water Quality Standards. Effluent limitations will be modified consistant with an acceptable demonstration.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Discharge to the Ohio River.

1/ The receiving water shall not exceed (1) a maximum water temperature change of 2.8°C(5.0°F) relative to an upstream control point and (2) maximum temperatures noted below outside of a mixing zone which shall not exceed the dimensions of a circle of 50-foot diameter:

Jan	10°C (50°F)	April	21 (70)	July	32 (89)	Oct	26 (78)
Feb	10 (50)	May	27 (80)	Aug	32 (89)	Nov	21 (70)
Mar	16 (60)	June	31 (87)	Sept	31 (87)	Dec	14 (57)

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 003 1/ - Boiler Blowdown Discharged to Ash Pond (Units 1-4)
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	N/A	N/A	1/week	Calculation
Copper, Total (mg/l)	1.0	1.0	1/month	Grab
Iron, Total (mg/l)	1.0	1.0	1/month	Grab

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1/ Serial number assigned for identification and monitoring purposes.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): in the boiler drum, flash tanks or prior to mixing with any other waste stream (four discharge points).

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 004 1/ - Cooling tower blowdown from Units 1 - 4 discharged to the ash pond

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/Day (MGD) Units 1 & 2	N/A	N/A	2/	2/
Flow-m^3/Day (MGD) Units 3 & 4	N/A	N/A	1/week	Weir elevati
Temperature °C(°F)	N/A	N/A	1/week	Grab
Copper (mg/l)	N/A	N/A	1/month	Composite

Consistent with ash sluice requirements, discharge of blowdown from the Unit 1 and 2 cooling towers shall be limited to the minimum discharge of recirculating water necessary for the purpose of discharging materials contained in the process, the further build-up of which would cause concentrations or amounts exceeding limits established by best engineering practice. Discharge of blowdown from the Unit 3 and 4 cooling towers shall be limited to the minimum discharge of recirculating water necessary for the purpose of discharging materials contained in the process, the further build-up of which would cause concentrations or amounts exceeding limits established by best engineering practice. Annual reports on cooling tower operation shall be submitted showing compliance with this requirement. Such reports shall be submitted along with the first quarterly monitoring report submitted after January 1, of each year.

Blowdown from Units 3 and 4 shall contain no detectable amount of materials added for corrosion inhibition including, but not limited to zinc, chromium and phosphorus.

1/ Serial number assigned for identification & monitoring purposes.
2/ Frequency and sample type shall be adequate to quantify any blowdown flow released which exceeds ash sluicing requirements.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): discharge from the cooling towers prior to mixing with other waste streams (four discharge points).

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through completion of construction of Unit 4 the permittee is authorized to discharge from outfall(s) serial number(s) 005 1/ - Construction Sewage Treatment Plant Effluent discharged to ash pond (Units 1-4)
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	7-Day Average	Daily Avg	7-Day Average	Measurement Frequency	Sample Type
Flow—m³/Day (MGD)	N/A	N/A	57(0.015)		1/week	Grab
BOD 5	1.70(3.8)	2.6(5.6)	30	45	1/month	Grab 2/
Total Suspended Solids	1.70(3.8)	2.6(5.6)	30	45	1/month	Grab 2/
Settleable Solids ml/1,	N/A	N/A	1.0	1.0	5/week	Grab
Chlorine Residual	N/A	N/A	N/A	N/A	5/ week	Grab
Fecal Coliform 3/ (organisms/100 ml)	N/A	N/A	200	400	1/quarter	Grab

In addition to the specified limits, the daily average effluent BOD_5 and suspended solids concentration shall not exceed 15% of the respectively daily average influent concentration.

1/ Serial number assigned for identification and monitoring purposes.
2/ Influent & effluent.
3/ Geometric mean.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s):
Sewage treatment plant effluent prior to mixing with any other waste stream.

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on completion of construction of Unit 4 and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 005 1/ - Operation Sewage Treatment Plant Effluent discharged to ash pond (Units 1 - 4)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	7-Day Average	Daily Avg	7-Day Average	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	28(0.0075)		1/week	Grab
BOD 5	0.85(1.9)	1.3(2.8)	30	45	1/month	Grab 2/
Total Suspended Solids	0.85(1.9)	1.3(2.8)	30	45	1/month	Grab 2/
Settleable Solids, ml/1	N/A	N/A	1.0	1.0	5/week	Grab
Chlorine Residual	N/A	N/A	N/A	N/A	5/ week	Grab
Fecal Coliform 3/ (organisms/100 ml)	N/A	N/A	200	400	1/quarter	Grab

In addition to the specified limits, the daily average effluent BOD_5 and suspended solids concentration shall not exceed 15% of the respectively daily average influent concentration.

1/ Serial number assigned for identification and monitoring purposes.
2/ Influent & effluent.
3/ Geometric mean.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Sewage treatment plant effluent prior to mixing with any other waste stream.

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 006 1/ - Metal Cleaning Wastes discharged to the ash pond after necessary pretreatment (Units 1, 2, 3, and 4).
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	N/A	N/A	1/batch	composite/calculation
Copper, Total (mg/1)	See Below		1/batch	composite/calculation
Iron, Total (mg/1)	See Below		1/batch	composite/calculation
Phosphorus, as P (mg/1)	N/A	1.0 2/	1/batch	composite/calculation

Metal cleaning wastes resulting from chemical cleaning compounds, rinse waters from chemical cleaning, or any other waterborne residues derived from chemical cleaning any metal process equipment including, but not limited to, boiler tube cleaning, boiler fireside cleaning and air preheater cleaning, shall be disposed of off-site in an environmentally acceptable manner. Details of such disposal shall be submitted not later than 180 days prior to any cleaning operation.

The quantity of total iron and total copper from water wash metal cleaning operations discharged from Units 3 and 4 shall not exceed the quantity determined by multiplying the flow of water wash metal cleaning wastes times 1.0 mg/1, respectively, as documented by an equivalency demonstration utilizing analyses of the intake and ash pond and any necessary pretreatment facility.

There shall be no discharge of metal cleaning wastes to any plant waste stream from Units 1 and 2 except for water wash operations included in Part III.E.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): discharge from the metal cleaning wastes pretreatment facility or commensurate with equivalency demonstration.

1/ Serial number assigned for identification and monitoring purposes.
2/ Applicable only to preoperational cleaning wastes unless such wastes are retained in a holding pond with no discharge or are disposed of by land application in an environmentally acceptable manner. Details of such disposal shall be provided to the Regional Administrator for approval not less than 180 days prior to cleaning operations.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 007 1/ - **Point source(s) runoff** from construction (Units 1 - 4)

Such discharges shall be limited and monitored by the permittee as specified below:

Point source construction runoff shall be discharged to the ash pond without limitation or monitoring requirements.

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1/ Serial number assigned for identification.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 008 - Once-through cooling water for plant heat exchangers to the Ohio River (Units 3 and 4) and yard drainage

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	N/A	N/A	1/week	Weir reading or staff gauge
Discharge Temperature °C(°F)	1/	1/	1/week	Grab
Total Chlorine Residual	See Below		1/week	Multiple Grabs

Total residual chlorine shall not exceed a maximum instantaneous concentration of 0.3 mg/l nor an average of 0.2 mg/l for a maximum period of one hour per day. In the event that the system(s) cannot be operated at or below this level of chlorination, the applicant may submit a demonstration, based on biological toxicity data, that discharge of higher levels of chlorine are consistant with toxicity requirements of the Kentucky Water Quality Standards. Effluent limitations will be modified consistant with an acceptable demonstration.

Yard drainage may be discharged without limitation or monitoring requirements.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Discharge to the Ohio River

1/ The receiving water shall not exceed (1) a maximum water temperature change of 2.8°C(5.0°F) relative to an upstream control point and (2) maximum temperatures noted below outside of a mixing zone which shall not exceed the dimensions of a circle of 50-foot diameter:

Jan.	10°C (50°F)	April	21°C (70°F)	July	32°C (89°F)	Oct.	26°C (78°F)
Feb.	10°C (50°F)	May	27°C (80°F)	Aug.	32°C (89°F)	Nov.	21°C (70°F)
Mar.	16°C (60°F)	June	31°C (87°F)	Sept.	31°C (87°F)	Dec.	14°C (57°F)

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A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on effective date and lasting through expiration
the permittee is authorized to discharge from outfall(s) serial number(s) 009 - Intake Screen Backwash (Units 1-4)

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type

Intake screen backwash (two points of discharge) may be discharged without limitation or monitoring requirements.

Debris removed from the intake screens shall be disposed of in an environmentally acceptable manner.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning at start of discharge and lasting through expiration the permittee is authorized to discharge from outfall(s) serial number(s) 010 1/ - **Plant Intakes**

Such discharge shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow-m^3/day (MGD)	N/A	N/A	Continuous	Pump logs
Temperature °C(°F)	N/A	N/A	Continuous	Recorder
Total Copper (mg/l)	N/A	N/A	1/month	Composite

1/ Serial number assigned for identification and monitoring purposes.

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Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Plant intakes. Groundwater intake flow shall also be provided.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:
    a. Route low volume waste, boiler blowdown, and material storage runoff to ash pond and/or achieve operational level of waste treatment (001, 002, 003, 004, 005, and 006)
        (1) Unit 1 - on effective date
        (2) Unit 2 - on start of discharge
    b. Waste treatment facilities for Units 3 and 4 (001, 003, 004, 005, 006, 007, and 008)
        (1) Achieve operational level - on start of discharge
    c. Blowdown report Units 3 and 4 cooling systems (004) - Annual reports submitted with first quarterly monitoring report for each year
    d. Metal cleaning waste disposal report (006) - 180 days prior to any metal cleaning operation
    e. PCB report - 12/31/77 (III.C.)
    f. 316(b) study (Units 1 - 4 (III.H.))
        (1) Study plan - one year prior to commercial operation date of Unit 4
        (2) Start study - 3 months after commercial operation date of Unit 4
        (3) Submit report - 18 months after commercial operation of Unit 4
    g. Flow report Units 3 and 4 (III.I.)
        (1) First report - 15 months after commercial operation date of Unit 3
        (2) Second report - 15 months after commercial operation date of Unit 4
    h. Condenser tube report (III.J.) - annually after commercial operation date of Unit 3
    i. Thermal plume reports (001, 002, and 008 (III.K.))
        (1) First report - 15 months after commercial operation date of Unit 3
        (2) Second report - 15 months after commercial operation date of Unit 4
    j. Sediment and erosion control (III.N.)
        (1) Implement plan - On start of construction
        (2) First report - four months after start of construction
        (3) Second, third & fourth reports - quarterly after first report
        (4) Subsequent reports - annually after fourth report
    k. Groundwater monitoring plan (III.O.)
        (1) Implement plan - as directed by Regional Administrator
        (2) Reports - quarterly with first report due four months after start of monitoring

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

Note: Any construction of new waste treatment facilities or alterations to existing waste treatment facilities will require a permit or authorization for construction in accordance with applicable state law and regulations.

C. MONITORING AND REPORTING

1. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. *Reporting*

Monitoring results obtained during the previous 3 months shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on 1/ . Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

Regional Administrator
Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30308

AND

Department for Natural Resources
and Environmental Protection
Century Plaza, U.S. 127 South
Frankfort, Kentucky 40601

3. *Definitions*

a. The "daily average" concentration means the arithmetic average (weighted by flow) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow) of all the samples collected during that calendar day.

b. The "daily maximum" concentration means the daily determination of concentration for any calendar day.

c. "Weighted by flow" means the summation of each sample concentration times its respective flow in convenient units divided by the summation of the flow values.

d. "Nekton" means free swimming aquatic animals whether of freshwater or marine origin.

e. For the purpose of this permit, a calendar day is defined as any continuous 24-hour period.

1/ Continuation of present monitoring program.

f. The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

g. The "daily maximum" discharge means the total discharge by weight during any calendar day.

4. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. *Additional Monitoring by Permittee*

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

7. *Records Retention*

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

A. MANAGEMENT REQUIREMENTS

1. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass.

6. *Removed Substances*

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

7. *Power Failures*

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

or, if such alternative power source is not in existence, and no date for its implementation appears in Part I,

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. *Right of Entry*

The permittee shall allow the head of the State water pollution control agency, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. *Transfer of Ownership or Control*

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency.

3. *Availability of Reports*

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. *Toxic Pollutants*

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected hereby.

PART III

THER REQUIREMENTS

A. In the event that waste streams from various sources are combined for treatment or discharge, the quantity of each pollutant or pollutant property attributable to each controlled waste source shall not exceed the specified limitation for that waste source.

B. If the permittee, after monitoring for at least 12 months, determines that he is consistently meeting the effluent limits contained herein, the permittee may request of the Regional Administrator that the monitoring requirements be reduced to a lesser frequency or be eliminated.

C. There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid. Administrative procedures shall be insituted to (1) maintain a detailed inventory of PCB use, (2) assure engineering design and construction to preclude release of PCB's to the environment, and (3) effectively detect the loss of PCB's from equipment. Detail of such procedures shall be submitted no later than December 31, 1977.

D. The company shall notify the Regional Administrator in writing not later than sixty (60) days prior to instituting use of any additional biocide or chemical in cooling systems, other than chlorine, which may be toxic to aquatic life other than those previously reported to the Environmental Protection Agency. Such notification shall include:

1. name and general composition of biocide or chemical,
2. 96-hour median tolerance limit data for organisms representative of the biota of the waterway into which the discharge shall occur,
3. quantities to be used,
4. frequencies of use,
5. proposed discharge concentrations, and
6. EPA registration number, if applicable.

E. Low volume wastes from Units 1 and 2 (waste water from all sources except those for which specific limitations are otherwise required in this permit, including, but not limited to waste waters from wet scrubber air pollution systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, floor drainage, water washing of air preheaters and boiler fireside, cooling tower basin cleaning wastes and blowdown from recirculating house service water systems) shall be discharged to the ash pond. Permittee shall continue established procedures designed to minimize oil and grease discharges.

F. Low volume wastes from Units 3 and 4 (wastewater from all sources except those for which specific limitations are otherwise required in this permit, including, but not limited to waste waters from wet scrubber air pollution control systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, floor drainage, cooling tower basin cleaning wastes and blowdown from recirculating house service water systems) shall be discharged to the ash pond. Permittee shall continue established procedures designed to minimize oil and grease discharges.

G. The flow from material storage runoff, up to and including the flow resulting from a 24-hour rainfall event with a probable recurrance interval of once in ten years, shall be routed to the ash pond without limitation or monitoring requirements and flows exceeding this amount may be by-passed to the river.

H. In accordance with Section 316(b) of the Act, by three months after the date of commercial operation of Unit 4 the permittee shall implement an approved program to monitor nekton and shellfish impinged on plant intake structures and fish eggs and larvae and other organisms entrained by the cooling water system during the months of March through August. A study plan shall be submitted for approval not later than one year prior to commercial operation date of Unit 4. Such study shall be in conformance with "Basic Guide to the Design of 316 Demonstrations, Region IV EPA (August 7, 1974)."

By 18 months after the date of commercial operation of Unit 4, the permittee shall submit a summary report to the Regional Administrator and State Director as to the effects of the present cooling water intake with regard to Section 316(b) of the Act relative to Units 1 - 4. If significant impingement and entrainment is occurring this report shall include.

1. An evaluation of facility or procedure modifications, to minimize the environmental impact of the cooling water intake,
2. An evaluation of methods to return viable nekton and shellfish collected on the intake screens to ambient temperature water at a point outside the influence of the plant intake and discharge, and
3. Proposed facilities or modifications with attendant implementation schedule(s) for implementing 1 and/or 2 above.

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Upon the direction of the Regional Administration, subject to hearing and review, the permittee shall implement construction of approved facilities in conformance with an approved implementation schedule.

I. Subsequent to commercial operation date of Unit 3 and 4, respectively, the permittee shall conduct a detailed evaluation of actual water use and inplant waste discharges to confirm design flow data. Reports of this evaluation shall cover a one year period after startup of each unit and shall be submitted not later than 15 months after commercial operation date of each unit. In the event that actual flow data is significantly different from design data, permit may be modified by the Regional Administrator.

J. The permittee shall provide a technical study that correlates operations experience with condenser tubes and demonstrates a sufficiently low corrosion/erosion rate to assure protection of aquatic organisms. A study plan shall be submitted not later than one year prior to the commercial operation date of Unit 3. Annual reports of study results shall be submitted starting one year after commercial operation date of Unit 3.

K. Subsequent to commercial operation of each unit, field measurements (supplemented as necessary with modeling results) shall be conducted to determine three dimensional configuration of the thermal plumes and to assure conformance with assigned thermal mixing zones. A thermal plume report shall be submitted not later than 15 months after commercial operation dates for each unit.

L. Additional monitoring of the ash pond effluent (001) and plant intake (010) shall be conducted at a frequency of once per month to assure conformance with applicable water quality standards. Parameters shall include calcium; chloride; magnesium; nitrate; sodium; sulfate; total alkalinity; total hardness; total phosphorus; total, dissolved, settleable and suspended solids; and total aluminum, arsenic, chromium, copper, iron, lead, manganese, mercury, nickel, selenium and zinc. After monitoring for a period of 12 months, the permittee may request of the Regional Administrator that the monitoring requirements be reduced to a lesser frequency or be eliminated.

M. Permittee shall operate and maintain barge loading and unloading facilities in such a manner as to prevent, and to the extent possible preclude, any and all spills to the Ohio River of oil, coal, or chemicals used at the facility, and shall take all actions necessary to clean up and control any such spill which may occur. Permittee shall comply with applicable requirements and procedures of 40 CFR Part 112, Oil Pollution Prevention.

N. On start of construction, the permittee shall implement the Erosion and Sedimentation Control Plan approved by the Regional Administrator on ____________________. A monitoring report shall be submitted quarterly during the first year of construction and annually thereafter. The report shall be submitted within one month after completion of the monitoring period, with the first report due four months after start of site construction.

O. The permittee shall implement the Groundwater Monitoring Plan approved by the Regional Administrator on ____________________. The Permittee shall monitor monthly using EPA approved methods to determine the following constituents in the groundwater downgradient of the ash pond and coal storage areas; copper, iron, lead, mercury, nickel, selenium, chloride, total suspended solids, and total dissolved solids. If the quarterly reports demonstrate significant increases, as determined by the Regional Administrator, in contamination of groundwater, the Permittee shall implement measures acceptable to the Regional Administrator to control this contamination. Such measures may include but are not limited to: sealing, relocating, or alternate location of the ash pond, coal storage and other waste disposal areas. If the quarterly report demonstrates no significant increasing contamination, the Permittee, after consultation and with the approval of the Regional Administrator, may reduce or eliminate the monitoring program.

P. No herbicides shall be used during initial transmission corridor clearing. Maintenance use of herbicides shall be limited to EPA registered products and in strict accordance with the label instructions governing their usage.

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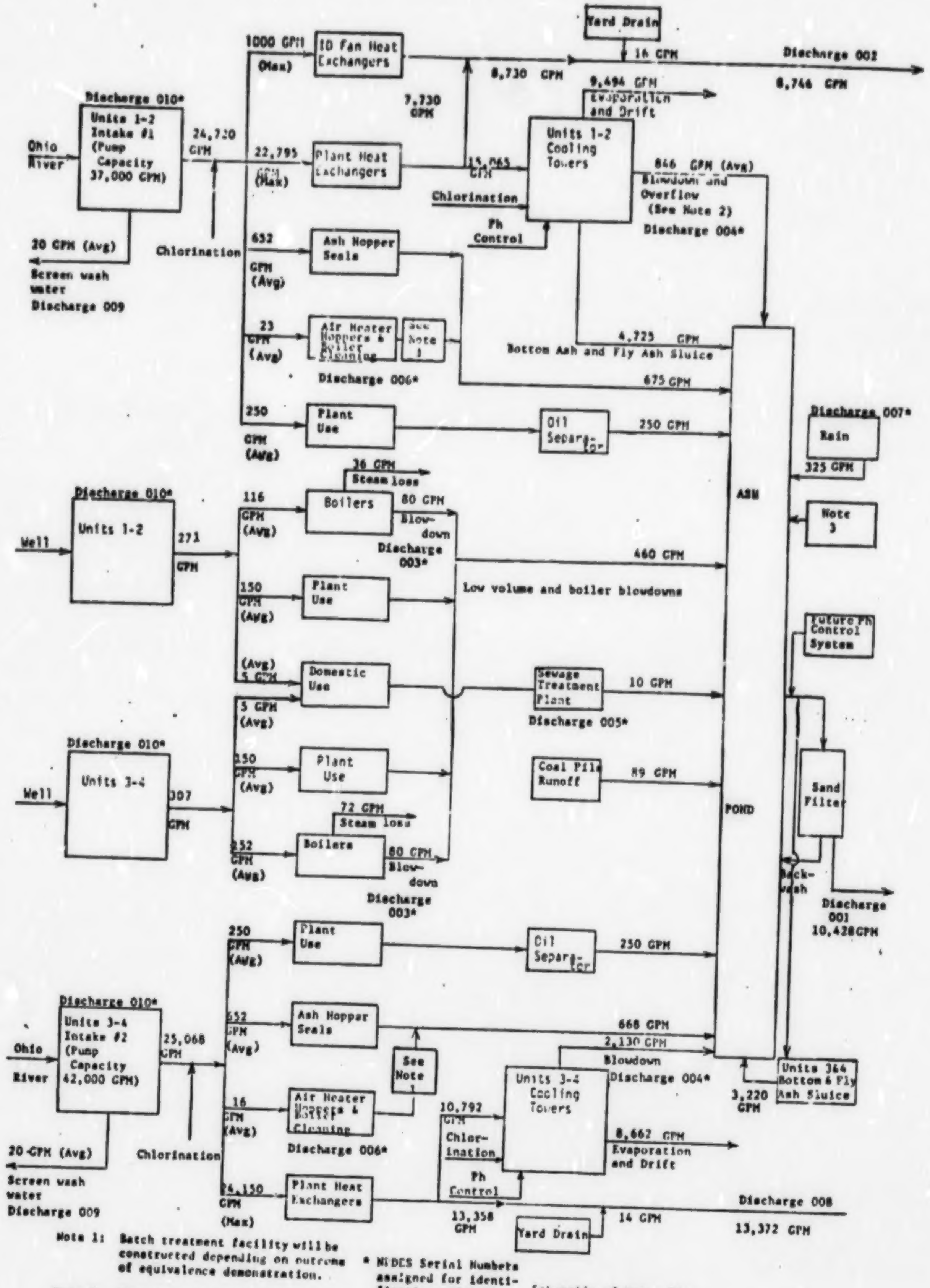

Note 1: Batch treatment facility will be constructed depending on outcome of equivalence demonstration.

Note 2: When there is no ash sluicing, supplemental blowdown rates will be 995 GPM - Unit 1 and 1035 GPM - Unit 2. This is for 10 hours per day per unit.

Note 3: The rain water run off from construction will be pumped to the ash pond.

* NPDES Serial Numbers assigned for identification and monitoring purposes.

Schematic of Water Flow
Kentucky Utilities Co. Units 1 thru
Ghent Generating Station Carroll Co
Ghent, Kentucky

Attachment A

ATTACHMENT B
EFFLUENT LIMITATION RATIONALE
SERIAL NUMBERS 001 and 005
Ghent Generating Station
Units 1, 2, 3, and 4
(See Attachment A for Flow Diagram)

I. Serial number 001 - Ash Pond Effluent (Includes low volume waste, material storage runoff, metal cleaning waste after pretreatment, boiler blowdown, ash sluice water, cooling tower blowdown and area runoff)

A. Waste Flows, gpm (MGD)

1. Units 1 & 2	Daily Average	Daily Maximum
a. Ash Sluice	2,835	4,725
b. Ash Hopper Seals	652	652
c. Boiler Blowdown	80	80
d. Low Volume	400	400
e. Metal Cleaning	23	23
f. Domestic	5	5
g. Tower Blowdown	846	846
h. Rainfall	325	325
i. Coal Pile Runoff	45	45
Total Units 1 & 2	5,211 (7.50)	7,101 (10.23)
2. Unit 3		
a. Ash Sluice	0	0 (Recycled)
b. Ash Hopper Seals	326	326
c. Boiler Blowdown	40	40
d. Low Volume	200	200
e. Metal Cleaning	8	8
f. Domestic	2.5	2.5
g. Tower Blowdown	789	1,065
h. Rainfall	0	0
i. Coal Pile	44	44
Total Unit 3	1,410 (2.03)	1,685 (2.43)
Total Units 1 - 3	6,621 (9.53)	8,786 (12.65)
3. Unit 4		
a-h. Same as Unit 3	1,365	1,641
i. Coal Pile	0	0
Total Unit 4	1,365 (1.97)	1,641 (2.36)
Total Units 1 - 4	7,986 (11.50)	10,428 (15.02)

Note

gpm = gallons per minute, MGD = million gallons per day, mg/l = milligrams per liter, lbs/day - pounds/day, Kg/day = kilograms/day (1.00 Kg = 0.454 lb), Daily average - average over 30-day period, Daily maximum = average over 24-hour period, TSS = total suspended solids, O & G = oil and grease, and BOD_5 = five day biochemical oxygen demand.

ATTACHMENT B CONTINUED

B. Limitations for Units 1 - 3
  1. Flows
    a. Daily Average: 9.53 MGD
    b. Daily Maximum: 12.65 MGD

	Calculated Limitation lbs/day	Permit Limitations	
		Kg/day(lbs/day)	mg/l
2. TSS (Daily Avg.)	1590.6	720(1590)	20 1/
3. TSS (Daily Max.)	5278.2	2390(5280)	50 1/
4. O & G (Daily Avg.)	795.3	360(800)	10 1/
5. O & G (Daily Max.)	1583.5	720(1580)	15 1/

  6. Sample Calculation for Daily Average TSS:
    lbs/day TSS = 20 x 9.53 x 8.345 - 1590.56 2/

C. Limitations for Units 1 - 4
  1. Flows
    a. Daily Average: 11.50 MGD
    b. Daily Maximum: 15.02 MGD

	Calculated Limitation lbs/day	Permit Limitations	
		Kg/day(lbs/day)	mg/l
2. TSS (Daily Avg.)	1919.4	870(1920)	20 1/
3. TSS (Daily Max.)	6267.1	2840(6270)	50 1/
4. O & G (Daily Avg.)	959.5	440(960)	10 1/
5. O & G (Daily Max.)	1880.1	850(1880)	15 1/

II. Serial Number 005 - Sewage Treatment Plant Effluent

  A. During Construction Periods
    1. Flow used in calculations: 0.015 MGD

	Calculated Limitation lbs/day	Permit Limitations	
		Kg/day(lbs/day)	mg/l
2. BOD_5 & TSS (Daily Avg.)	3.76	1.7(3.8)	30
3. BOD_5 & TSS (Daily Max.)	5.63	2.6(5.6)	45

  B. During Plant Operation

Flows and limitations are one-half of construction values.

1/ Due to presence of waste streams without specific limitation, no limitation, and coal pile runoff (with a maximum instantaneous limitation of 50 mg/l), daily average of TSS concentration limitation has been reduced to 20 mg/l rather than 30 mg/l as allowed for low volume wastes and other waste categories and daily maximum has been reduced to 50 mg/l rather than 100 mg/l. O & G limitations have been reduced to 10 mg/l as a daily average rather than 15 mg/l and daily maximum of 15 mg/l rather than 20 mg/l.

2/ Calculation Formula: lbs/day = mg/l x MGD x 8.345

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
LOUISVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 59
LOUISVILLE, KENTUCKY 40201

ORLOP-SP

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PUBLIC NOTICE

TO WHOM IT MAY CONCERN:

KENTUCKY UTILITIES COMPANY, 120 South Limestone Street, Lexington, Kentucky 40507, has applied to this office for a Department of the Army (DA) Permit subject to Section 10 of the River and Harbor Act of 1899 and Section 404 of the Federal Water Pollution Control Act Amendments of 1972 to install a service water screenhouse and discharge structure, place fill material and riprap, drive sheet piling and dredge. The site of the proposed work is on the left bank of the Ohio River, 536.4 miles below Pittsburgh, Pennsylvania, near Ghent, Carroll County, Kentucky. The proposed work would be in conjunction with the construction of the proposed Ghent Generating Station Units 3 and 4, designed for fossil fuels.

The U. S. Environmental Protection Agency (EPA) is the lead Federal agency because it will be necessary for EPA to issue a National Pollutant Discharge Elimination System (NPDES) Permit subject to Section 402 of the Federal Water Pollution Control Act Amendments of 1972 for the proposed work. As lead agency, EPA is responsible for making the decision as to whether construction of the entire facility is in the overall public interest. Pursuant to that responsibility, EPA has prepared a draft Environmental Impact Statement (EIS) on the effects of the proposed project. A copy of the draft EIS has been submitted to the Council on Environmental Quality (CEQ).

The decision whether to issue a DA Permit will be based solely on considerations of the effect that that part of the proposal subject to Section 10 would have on navigability and the effect that the part of the proposal subject to Section 404 would have on water quality.

Any person who has an interest, as mentioned in the previous paragraph, which may be adversely affected by the issuance of the requested DA Permit may request a public hearing. The request must be submitted in writing to the District Engineer within thirty days of the date of this notice and must clearly set forth the interest which may be adversely affected and the manner in which the interest may be adversely affected by the activity.

Information in this office and the accompanying plans indicate that two coal fired steam electric generating units (Units 1 & 2) were authorized by DA

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Public Notice No.

Permit F70-026. Presently, Unit 1 is operational and Unit 2 is under construction and expected to be in operation in 1977. The applicant proposes to construct two additional coal fired steam electric generating units (Units 3 & 4). Each unit would have a gross rating of 550 megawatts (MW) with an expected net rating of 500 MW. When complete, the Ghent Generating Station would have four units with a total net generating capacity of 2,000 MW. A 345 KV transmission line is proposed to connect the Ghent Station to a load center about five miles west of Frankfort, Kentucky. The transmission line crossing the Kentucky River would be applied for on a separate DA Permit application at a later date.

The purpose of the screenhouse would be to supply service water to the power plant units. Sheet piles would be driven to elevation 368 feet above mean sea level (msl) to form a cofferdam before the construction of the screenhouse. Approximately 2,500 cubic yards would be dredged from the area inside the cofferdam and would be placed in the area designated on sheet 1 of the inclosed drawings. Approximately 2,200 cubic yards of tremie and structural concrete would be used to construct a 36' x 4 ' 2" concrete structure supported on a reinforced concrete mat foundation. An access bridge would be constructed connecting the top of the screenhouse with the power plant area.

The intake structure is so designed that the water intake velocity through the bar grills and in the forebay upstream of the traveling screen would be 0.48 ft./sec. This water intake velocity was calculated assuming a maximum pump design withdrawal rate (21,000 gallons per minute) and an intake opening between elevation 409 feet msl and 419 feet msl.

The purpose of the discharge structure would be to discharge plant service water and surface drainage into the Ohio River. The discharge structure would be constructed of a 4 foot diameter pipe buried within the bank of the river with a minimum cover of 3 foot of compacted fill. Approximately 650 cubic yards of riprap would be placed to a depth of 18" over 320 cubic yards of bedding placed to a depth of 6".

A DA Permit cannot be issued until the applicant furnishes this office a copy of the water quality certification and state construction permit from the Kentucky Department for Natural Resources and Environmental Protection.

The National Register of Historical Places has been consulted, and it has been determined that there are no properties currently listed on the register which would be affected by the proposed work. If we are made aware,

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as a result of comments received in response to this notice or by other means, of specific archaeological, scientific, prehistorical, or historical sites or structures which might be affected by the proposed work, the District Engineer will immediately notify EPA for appropriate handling pursuant to Section 4 of Public Law 93-291.

Written statements received in this office on or before will become a part of the official record, as such will be available for public examination and will be considered in the determination. Any objections which are received during this period may be forwarded to the applicant for possible resolution before the determination is made whether to issue or deny the requested DA Permit.

FOR THE DISTRICT ENGINEER:

W. N. WHITLOCK
Chief, Operations Division

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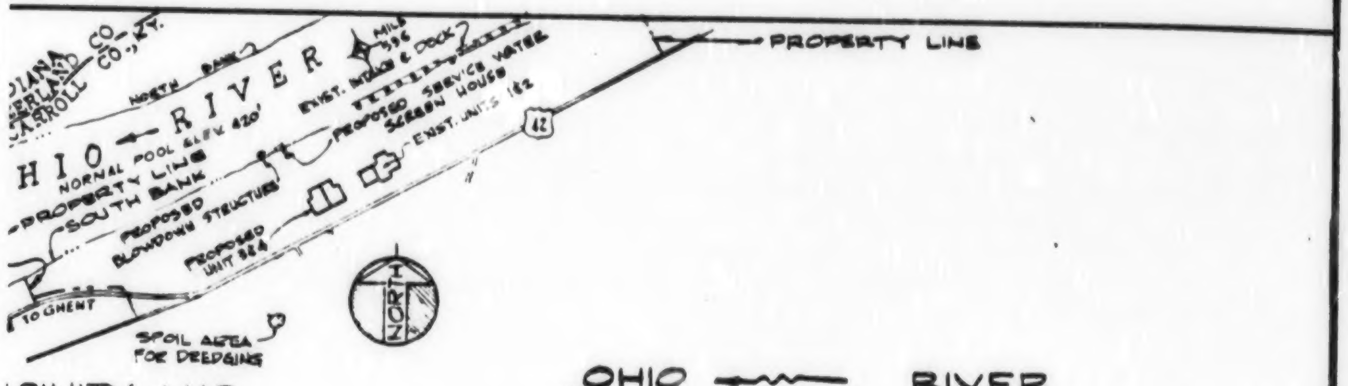
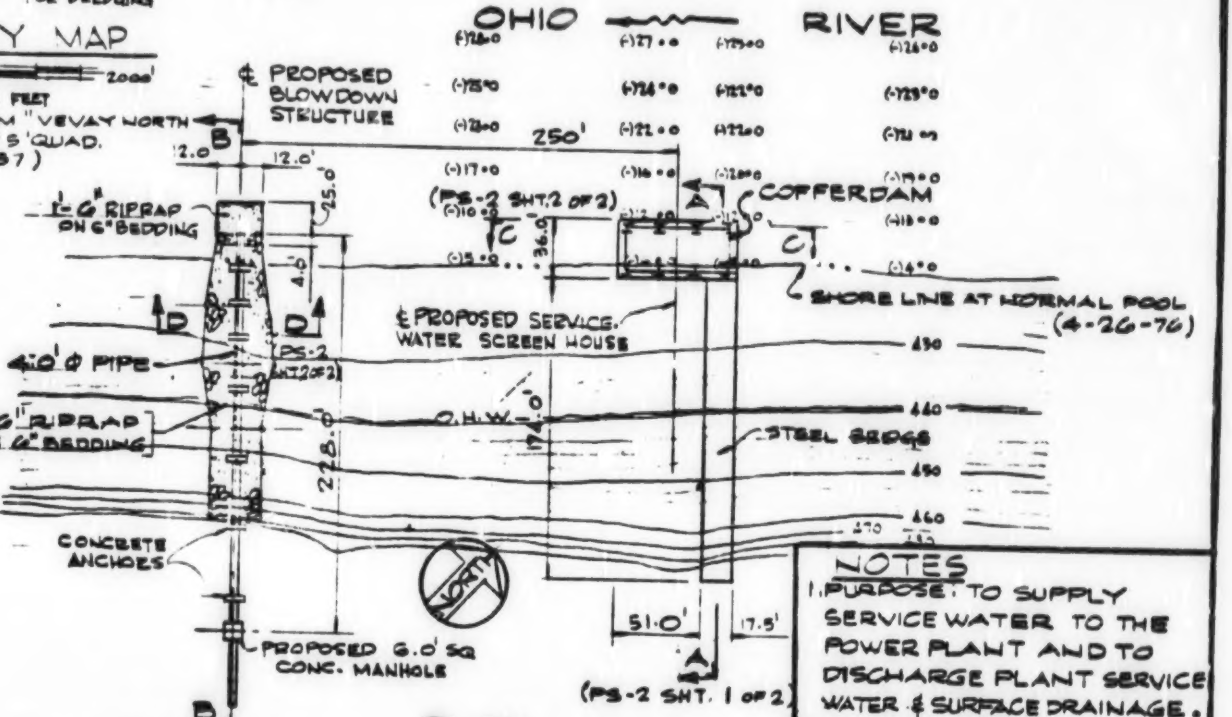


ICINITY MAP

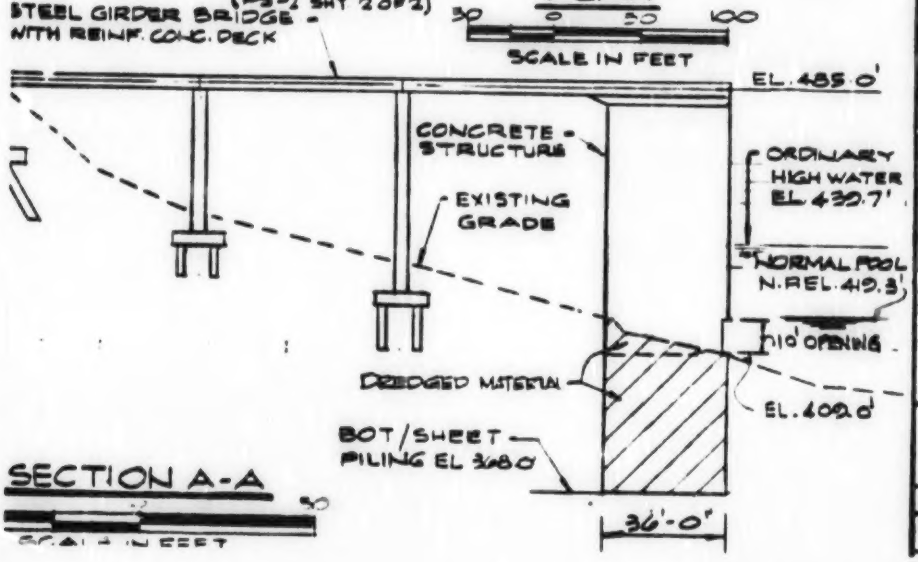
SCALE IN FEET 2000'

IED FROM "VEVAY NORTH
D.-KY." 7.5' QUAD.
.G.S. 1957)



PLAN

SCALE IN FEET 50 0 50 100


STEEL GIRDER BRIDGE WITH REINF. CONC. DECK
EL. 485.0'
CONCRETE STRUCTURE
ORDINARY HIGH WATER EL. 432.7'
EXISTING GRADE
NORMAL POOL N.P.EL. 419.3'
10' OPENING
DREDGED MATERIAL
EL. 409.0'
BOT/SHEET PILING EL. 368.0'
36'-0"

SECTION A-A

SCALE IN FEET 0 50

NOTES

1. PURPOSE: TO SUPPLY SERVICE WATER TO THE POWER PLANT AND TO DISCHARGE PLANT SERVICE WATER & SURFACE DRAINAGE.
2. ALL ELEV. REFER TO MSL.
3. FOR EARTHWORK QUANTITIES BELOW O.H.W., SEE SHT. 2 OF 2.
4. ADJACENT PROPERTY OWNER
   1. WALTON O'NEAL (EAST)
   2. P.C. FROMAN (WEST)

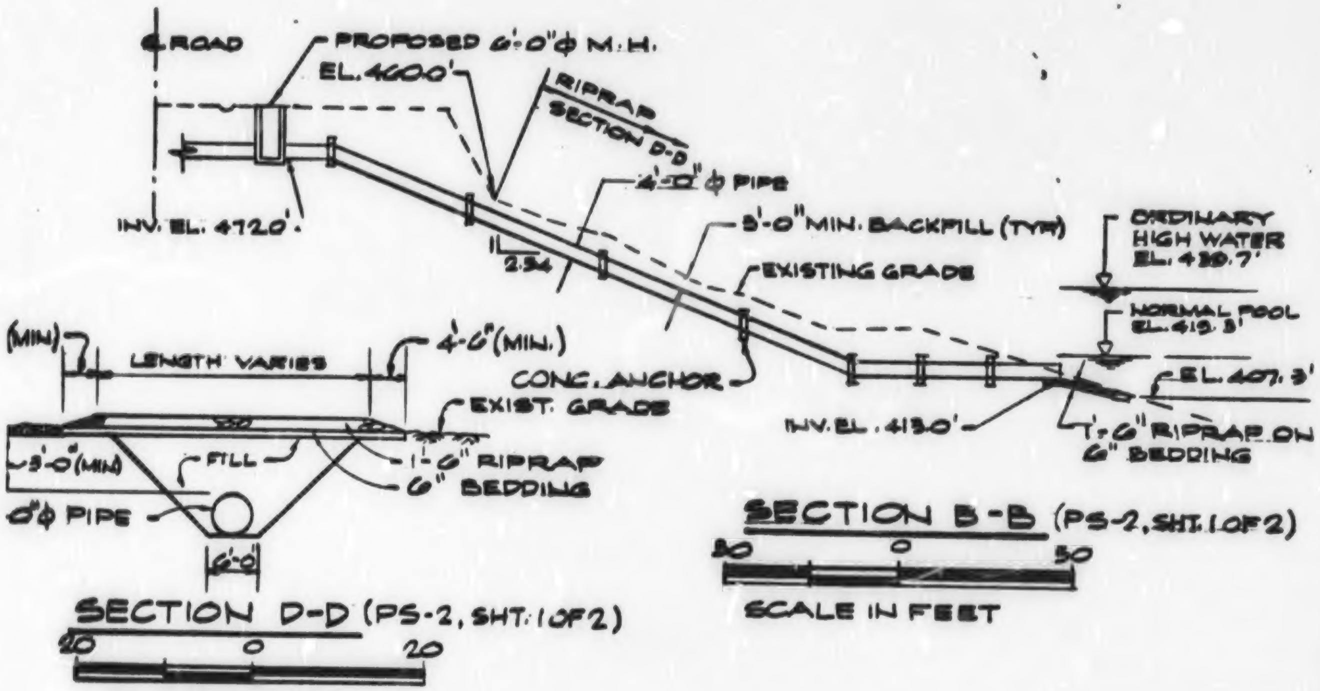
GHENT GENERATING STA. UNIT 3&4

PROPOSED SERVICE WATER
SCREENHOUSE AND DISCHARGE
STRUCTURE IN
OHIO RIVER
COUNTY OF CARROLL,
COMMONWEALTH OF KENTUCKY,
APPLICATION BY:
KENTUCKY UTILITIES COMPANY,
LEXINGTON, KENTUCKY.

SCALE AS SHOWN
DRAWN A. BALINGIT
CHECKED
ENGINEER
APPROVED
REVISED

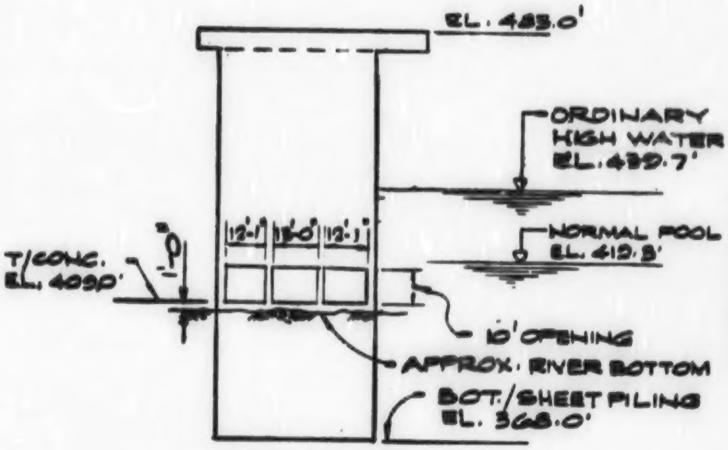
SARGENT & LUNDY
ENGINEERS
CHICAGO

JOB NO	DRAWING NO
5011	PS-2 SHT. 1 OF 2



SECTION B-B (PS-2, SHT. 1 OF 2)

SECTION D-D (PS-2, SHT. 1 OF 2)



SECTION C-C (PS-2 SHT. 1 OF 2)

S N	ITEM	LOCATION		QUANTITIES IN C.Y.		
		LAT.	LONG.	EXC.	FILL	RIPRAP & BEDDING
1.	INTAKE	38°-44'-37"	85°-02'-20"	2900 (DREDGE)	2200 (CONC.)	0
2.	BLOW-DOWN	38°-44'-36"	85°-02'-23"	700*	650	320

* TO BE USED AS BACKFILL

GHENT GENERATING STA. UNIT 3&4

PROPOSED SERVICE WATER
SCREENHOUSE AND DISCHARGE
STRUCTURE IN
OHIO RIVER
COUNTY OF CARROLL,
COMMONWEALTH OF KENTUCKY,
APPLICATION BY:
KENTUCKY UTILTIES CO.
LEXINGTON, KENTUCKY.

SCALE AS SHOWN
DRAWN A. BALINGIT
CHECKED 7-26
ENGINEER
APPROVED
REVISED

SARGENT & LUNDY
ENGINEERS
CHICAGO

JOB NO.	DRAWING NO
5011	PS-2 SHT. 2 OF 2

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JOINT PUBLIC NOTICE

U.S. Environmental Protection Agency
Region IV, Water Enforcement Branch
345 Courtland Street
Atlanta, Georgia 30308
404/881-2328

in conjunction with

Kentucky Department for Natural Resources and
Environmental Protection
Century Plaza - U.S. 127 South
Frankfort, Kentucky 40601

Public Notice No. PH77KY0091 August 25, 1977

NOTICE OF PUBLIC INFORMATION HEARING ON DRAFT ENVIRONMENTAL IMPACT STATEMENT, NOTICE OF PROPOSED ISSUANCE OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT, NOTICE OF AIR QUALITY APPROVAL TO CONSTRUCT, AND NOTICE OF CONSIDERATION FOR STATE CERTIFICATION

The U.S. Environmental Protection Agency (EPA) proposes to issue a modification to the National Pollutant Discharge Elimination System (NPDES) permit to Kentucky Utilities Company, 120 South Limestone Street, Lexington, Kentucky 40507, for its Ghent Generating Station, P.O. Box 338, Carroll County, Ghent, Kentucky 41045, application and permit number KY0002038. The modification will incorporate effluent limitations for two proposed units (Units 3 and 4) into the present permit for Units 1 and 2. The application describes three existing discharges for Units 1 and 2 and proposes two additional discharges from Units 3 and 4. The plant generates and transmits electricity, Sic Code 4911. The discharges enter the Ohio River in the vicinity of River Mile 536.5 which has been classified by the Commonwealth of Kentucky for all uses.

A Draft Environmental Impact Statement (EIS) was made available to the Council on Environmental Quality and to the public on August 26, 1977 by EPA. The Regional Administrator of EPA, Region IV, and the Commissioner of the Bureau of Environmental Quality, Kentucky Department for Natural Resources and Environmental Protection, have determined that a public hearing will be held to foster further public participation on the proposed issuance of necessary permits and approvals for the proposed project. The public hearing is scheduled for September 29, 1977, and will begin at 6:30 p.m. in the Carrollton Middle School at Fifth and Seminary Streets, Carrollton, Kentucky. The public hearing will be co-chaired by the EPA and the Kentucky Department for Natural Resources and Environmental Protection.

Both oral and written comments will be accepted and a transcript of the proceedings will be made. For the accuracy of the record, written comments are encouraged. The Hearing Officer reserves the right to fix reasonable limits on the time allowed for oral statements.

In addition to proposed issuance of the NPDES permit, EPA is proposing to give approval to construct the facility under the regulations for prevention of significant deterioration of air quality. A public notice of the proposed approval was published on March 23, 1977. The comment period on this proposed action has been extended to 30 days from the date of this notice. Persons wishing to comment on this air quality action are invited to submit comments to EPA, Region IV, Air Programs, 345 Courtland Street, N.E., Atlanta, Georgia 30308.

The proposed NPDES permit contains limitations on the amounts of pollutants allowed to be discharged and was drafted in accordance with the provisions of the 1972 Amendments to the Federal Water Pollution Control Act (P.L. 92-500) and other lawful standards and regulations. The pollutant limitations and other permit conditions are tentative and open to comments from the public at this hearing.

A fact sheet which outlines the applicant's current and proposed discharge(s) and EPA's proposed pollutant limitations and conditions is available by writing or calling the EPA. A copy of the draft permit is appended to the draft EIS and is also available from the EPA Region IV office. The application, supporting data, Draft Environmental Impact Statement, comments received, and other information are available for review and copying at 345 Courtland Street, N.E., Atlanta, Georgia 30308, between the hours of 8:15 a.m. and 4:30 p.m., Monday through Friday. A copying machine is available for public use at a charge of 20¢ per page.

The Kentucky Department for Natural Resources and Environmental Protection has been requested to certify the NPDES permit for the water discharge(s) of the proposed new units in accordance with the provisions of Section 401 of the Federal Water Pollution Control Act, as amended (P.L. 92-500). The Department will also perform a new source review to determine whether to issue a permit to construct the air contaminant source. Therefore, the Department will be a participant in the public hearing to receive comment on these actions and any other environmental matters relevant to the Department's authority.

Persons wishing to comment upon or object to the project, the NPDES permit issuance, the proposed permit limitations and conditions, the draft EIS, the approval to construct, and/or the state certification are invited to respond in writing by September 26, 1977, to the Enforcement Division, U.S. Environmental Protection Agency, 345 Courtland Street, N.E., Atlanta, Georgia 30308, ATTN: Ms. Mona Ellison, and the Kentucky Department for Natural Resources and Environmental Protection, Century Plaza - U.S. 127 South, Frankfort, Kentucky 40601. The NPDES number (KY0002038) should be included in the first page of comments. All comments received by September 26, 1977, will be considered in the formulation of final determinations regarding the Final EIS, the NPDES permit and permit conditions, the significant deterioration of air quality construction approval, and the state certification. Response to all substantive comments made at this public information hearing will be published in the Final EIS. Requests for adjudicatory hearings on the NPDES permit may be filed after the Regional Administrator makes the above described determinations. Additional information regarding adjudicatory hearing is available in the July 24, 1974 Federal Register, 39, page 27081 or by contacting the Legal Support Branch, Enforcement Division, at the address above or at 404/881-3506.

Copies of the draft EIS, which includes the draft NPDES permit, are also available for review at the following libraries:

1. Capital Regional Library, Frankfort, Kentucky
2. Carroll County Public Library, Carrollton, Kentucky
3. Lexington-Fayette County Public Library, Lexington, Kentucky
4. Louisville Free Public Library, Louisville, Kentucky
5. Madison-Jefferson County Public Library, Madison, Indiana
6. Ohio County Contractual Library, Rising Sun, Indiana
7. Public Library of Cincinnati and Hamilton County, Cincinnati, Ohio
8. Switzerland County Public Library, Vevay, Indiana
9. Trimble County Public Library, Milton, Kentucky

Please bring the foregoing to the attention of persons who you know will be interested.